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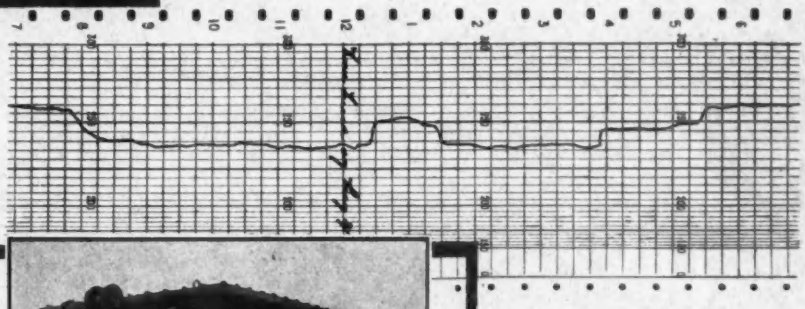
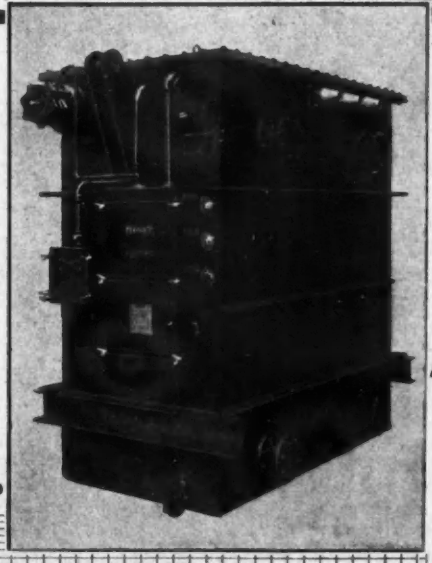
BEFORE

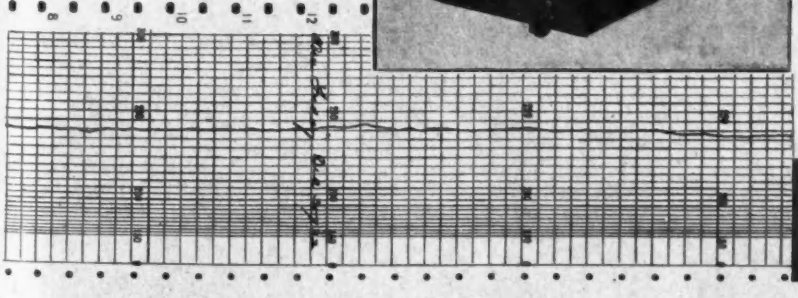


THE MOVING COIL AUTOMATIC VOLTAGE REGULATOR



AND

These voltage records were obtained at a sub-station in an industrial area of one of the largest English electricity supply undertakings.



AFTER

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HOLLINWOOD ENGLAND

WHY THEY CHOOSE ALUMINIUM

TRANSMISSION. Steel-cored aluminium is regularly specified in all climates. It has been chosen for the British National "grid," and the Grampian Electricity Supply Co.'s scheme, the Tummel-Rannock section of which is illustrated here by courtesy of Balfour, Beatty & Co., Ltd. The S-C-A combination of high conductivity aluminium with high tensile steel gives economy in conductors, towers and insulators ; its long spans reduce wayleave problems. (See B.A.C. Book No. 337, free on request.)

●

CASTINGS. A non-magnetic metal which is economical, easy to cast, easily machined and light and easy to handle (as is aluminium), must command attention. The illustration shows a 6,600-volt metal-clad switchboard manufactured by the G.E.C. All busbar chambers, end covers, transformer chambers, cable boxes and hoist gear wheels are aluminium. (See B.A.C. Book No. 339, free on request.)

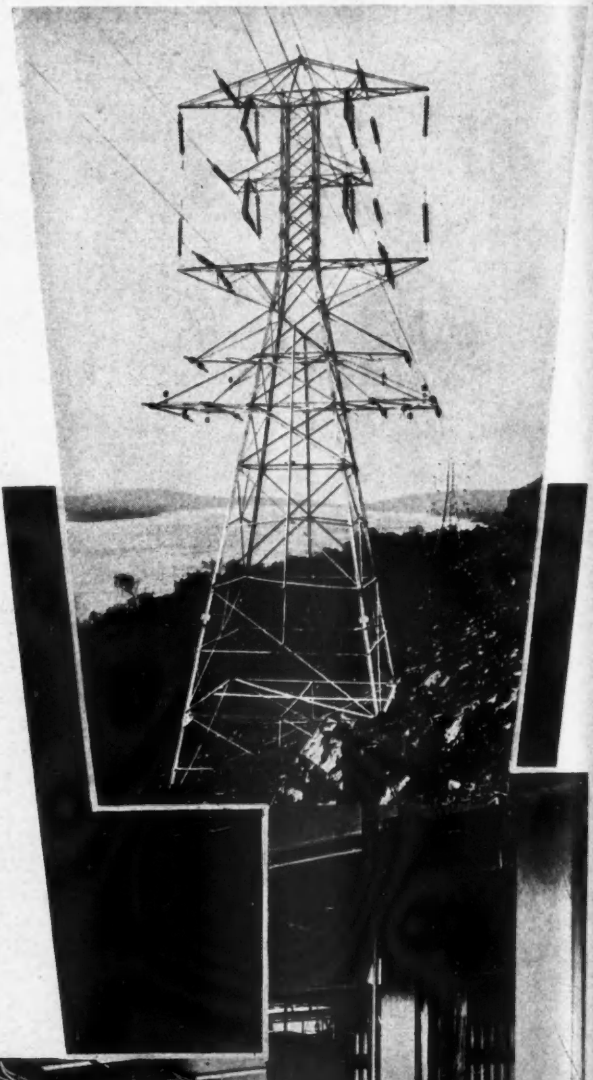
●

BUSBARS. Excellent mechanical rigidity, easy handling in erecting and working, ready bending, drilling, cutting, filing and cold-forging, these properties commend aluminium for busbar and rod. An aluminium busbar weighs half as much as a copper bar of equal resistance. It can carry the same current at a smaller temperature rise. Illustrated are aluminium conductors at the Newcastle-on-Tyne automatic telephone exchange, where eight tons of aluminium bars were used (supplied to the order of Standard Telephones & Cables, Ltd.). (See B.A.C. Book No. 351, free on request.)

●

RADIO. Amongst non-magnetic metals, aluminium is chosen because it is lower in cost, easy to work and possesses excellent electrical properties. The finished appearance of all components in aluminium is exceedingly pleasing. The Haynes A.C. Mains receiver shown has tooled-out aluminium base plates, and aluminium shielding pans for coils and valves. (See I.D.M. 26, free on request.)

●



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The Bournemouth Address

IN his presidential address to the Incorporated Municipal Electrical Association, Mr. Geoffrey Porter referred to the growing difficulty found by those who hold similar high office in choosing a theme on which to base their remarks. Although his own address followed the custom of bearing no title, we think that the trends now evident in our industry have presented to him a first-class subject, which might have been called "Co-operative Effort," a good example of which is provided in the I.M.E.A. itself.

It is the usual formality for the President of the Association to ask for support from supply undertakings for propaganda, research and technical standardisation, but Mr. Porter took the opportunity to give, with great lucidity, an outline of the objects and achievements of the representative bodies that deserves the widest publicity especially among committee-men. These decide the amounts to be allocated for the purposes named; the financial support is inadequate in many cases and even withheld in others, although it is easily demonstrated that all have received advantages of a very practical kind from the activities of the central associations.

Mr. Porter is driven to conclude that compulsory subscription within the industry is essential. This may ultimately prove to be the case, but it does not follow that further legislation will be necessary, as he implies. Any steps that may be taken to this end will merely register what is generally recognised as a standard, just as the grid itself merely gives concrete form to technical practice that has evolved since the beginning of this century.

Mr. Porter refers, with justice, to the extraordinary adaptability shown by men appointed in earlier days as chief engineers and managers of municipal undertakings in meeting the vast changes that have taken place in the technical, economic and administrative problems of electricity supply. He might have questioned the adaptability of some engineers in charge of undertakings at present. At all events, he is inclined to doubt whether the men who will fill the leading positions in the future are the equal of their predecessors in ability to cope with these problems.

This deficiency of future leaders he attributes to inadequate remuneration and—presumably as a consequence—the discouragement of younger men by their seniors from entering municipal service, and also to the method of systematised instruction given at colleges.

Our own contacts with younger supply engineers do not suggest to us such an inferiority. Their qualities may be different, but they may be even more suitable for the more centralised and scientific methods that have developed from the work of their predecessors.

Remuneration is better than it was, though perhaps not relatively to increasing responsibilities, but there still lurks in the minds of many committee-men the heresy that the closing down of a generating station reduces managerial responsibility. And may not the individualism of the older engineers, who achieved so much in the day of small things, prove in some cases a hindrance to the organised co-operative working which is now the keynote of electricity supply?

Don't Put on the Brakes

WE hope that there will not be any falling off in individual electricity supply enterprise while the Electrical Development Association is re-arming in readiness for its strong and sustained attack upon the citadel of ignorance. It will not be long before municipal councils separate for their vacation but schemes already prepared for new

showrooms, distribution extensions, tariff reductions and so forth, ought not to be held in abeyance until they resume, because of any hopes they may entertain that E.D.A. is going to do great things for them in a hurry. There is every ground for believing that the strengthened administration will be effective in the autumn, but it never will and never can take the place of the enterprise of those responsible for the undertakings. The normal operations of the organisation will continue during the next few months, side-by-side with the work of rearrangement, and whatever E.D.A. may be going to do in the future, it is the duty of every undertaking to be preparing its own plans. Then, when everything is ready, the central and local operations can proceed simultaneously, the latter drawing strength from the former.

The Best Way to Help

IN his timely article on "The Power Canvass" appearing on page 868 Mr. W. E. Swale once more directs attention to the need for setting a large business-getting or sales staff to work among non-users, or small users, of electricity. Many factories, like many homes, are being run inefficiently because they do not employ electricity. He mentions the demand persistently expressed editorially in the ELECTRICAL REVIEW during the past two years for an organised canvass in every electricity supply area. The objective aimed at in that discussion was less the preparation of a record of what had or had not been done, valuable as that would be, than the systematic organisation of a general campaign approaching the potential user of electricity for both industrial and domestic purposes. We agree with Mr. Swale that the best way to help the industry, and incidentally oneself, just now, is to "get out amongst our consumers and prove by facts and figures what electricity will really do for them." Our problem is not how to produce enough electricity; it is how to sell quickly what is available.

Little Things that Tell

MR. W. F. T. PINKNEY, writing on "Service to the Consumer," stresses the importance of the canvasser making the right impression upon the consumer from the first moment of approach. He must be given the impression that a genuine personal interest is taken in his requirements and well-being as a consumer. That is half the battle. The other half is "Service!" and again "Service!" even in matters of detail such as consulting the consumer before running the cable through his front garden heartlessly as though it were a pathway! Discourtesy leaves irritation, and irritation effectively prevents the promotion of those good relations which lead to success.

A Successful Year

THAT the electrical manufacturing business of Ward & Goldstone, Ltd., whose products are so familiar to our readers, continues to be of a progressive nature, is apparent from the figures given in the annual statement just issued. In times such as these it is no mean achievement to increase the net profit from £19,801 to £26,083, while it speaks well, both regarding the volume of orders in hand and the directors' hopes concerning trade prospects, when works extensions and equipment costing £17,000 are carried out. The dividend is maintained at the same figure as for several years past—probably it would have been higher but for the extensions mentioned and certain other developments. More than usual is placed to depreciation, and the carry-forward is also substantially larger.

The Convention Papers

THE papers read before the I.M.E.A. this week have been, on the whole, of more than average merit. That on domestic cooking, by Messrs. P. J. Robinson and E. E. Hoadley, provides a considerable amount of real information. Two of the authors or joint-authors of the other papers were men who are not yet chiefs. One of these, Mr. J. Eccles, has produced, in conjunction with Mr. E. Seddon, a paper on static sub-stations which should be found of great interest outside the administrative grades represented by the I.M.E.A. While giving a glimpse of the immense technical field between the busbars and the consumers' terminals—a point too often overlooked—it should also be of great practical interest to assistant engineers engaged on transmission and distribution work (the drawings of sub-station layouts alone make it worth close study), and they should certainly try to secure copies. Special tariffs require special metering gear; Mr. Lawson related the two in a paper which, though based mainly on experience with a large undertaking, has its general application, particularly with regard to pre-payment meters. Dr. Denham drew attention to the opportunities offered to undertakings in the farm load, and his paper was of interest mainly to those who have as yet taken no steps to cross the urban frontier.

Believing Our Own Story

THOSE undertakings that have the largest cooking loads are those run by engineers who, with their staffs, are most enthusiastic with regard to its advantages. This was the opinion expressed by Messrs. P. J. Robinson and E. E. Hoadley in their I.M.E.A. paper, which embodies data and curves derived both from their own experience and from that of other supply engineers whose faith has been justified by works. The authors evidently hold the sound view that electric cooking is well enough established for the truth about it to be known, and, while critical on some points, they have no difficulty in showing that it is more satisfactory than any other method. Their figures confirm the rule-of-thumb formula that electricity costs about the same as gas if its price in pence per kWh is one-tenth of the cost per therm, but, as the authors state, the consumers should not be expected to follow elaborate instructions regarding the use of electrical apparatus. Given a competitive tariff and hiring facilities, the authors believe that the development of the cooker load depends almost entirely upon efficient maintenance service. This is in agreement with the view often expressed in these columns.

Getting Ready for February

ONCE again the Castle Bromwich buildings for the British Industries Fair are to be extended. The work is in hand and the cost will be from £16,000 to £20,000. As will be seen by reference to the drawing published in the "Business Notes" pages of this issue, advantage has been taken of the extension to simplify the arrangement of the different sections. The electrical and engineering sections will feel the benefit. Attention has been given to such matters as wider gangways and more adequate entrances to give easier access to each individual section. The "electrical" floor space at Birmingham will be increased by 21,000 sq. ft. to 51,000 sq. ft. February, 1934, may be looked forward to with greater electrical trade expectations than ever.

What Was the Reason?

IT is more with regret than surprise that we learn that a substantial part of last week's issue of Central Electricity stock—£8,000,000 3½ per cent. at £93 10s. per cent.—was left with the underwriters. It may be that the terms of offer were not good enough to excite enthusiasm for so large an amount even when money is in spate at the banks, or it may be that the last days of the week were not the best; again, possibly the Board's publicity weapons need sharpening up. Perhaps it is partly due to all three circumstances. There was not an over-zealous attempt to promote a favourable atmosphere—indeed the issue came as quite a surprise to many. The stock will soon be absorbed and go to a premium, but it seems absurd for an issue of such stock to be unpopular when so many other issues are being overwhelmingly subscribed.

THE I.M.E.A. AT BOURNEMOUTH

Special Reports by "Electrical Review" Representatives at the Convention

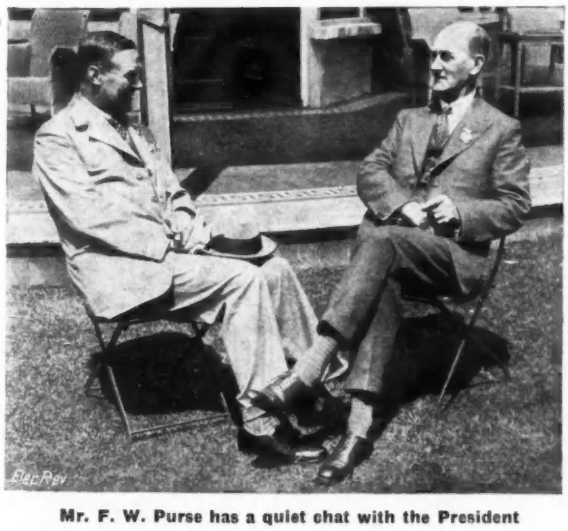
Bournemouth, MONDAY EVENING.

IT is now evident that the number of delegates at this year's Convention will be very few if any short of the Scarborough figure, rather over 1,100, the largest yet recorded. This is especially satisfactory in view of the interpretation placed by some municipalities upon the Ministry of Health's "economy circular" last winter, although this raised no objection to two representatives from each council attending a conference of any recognised association. As though any conference of municipal officials could equal in importance the most important gathering of electrical people in the year!

By this evening the number of arrivals who had drawn badges appeared to be well up to the average, but it seemed to us that fewer delegates had taken advantage of the opportunity to spend a week-end in Bournemouth, in spite of the manifold attractions of our second largest health resort. Among the early arrivals at the Royal Bath Hotel, the Council's headquarters, I found Mr. Geoffrey Porter (president), Mr. P. J. Robinson (vice-president), Mr. W. C. P. Tapper (hon. secretary), and Mr. J. W. Simpson (secretary).

An indication of the popularity of the various functions of the Convention is the great increase in the demand for tickets, the number of those wishing to attend the annual dinner on Thursday being 408—easily the high-water mark of the long series since the foundation of the I.M.E.A. in 1895. The rain which set in at tea-time on Sunday presented a test for the outlook of members—optimistic or otherwise. So far to-day the optimists are fully justified, as Bournemouth is maintaining its reputation for getting its full share of sunshine.

The future of E.D.A. has provided the chief topic of informal discussions. It is generally agreed that something had to be done about it, with a view to obtaining the requisite funds to extend its scope and make it a really live propagandist body. Most people seem inclined to wait upon events, but I did hear the comment that the C.E.B. would have done well not to limit its nominations to the National Consultative Committee, as inclusion of the District Committees would have given it a wider range of talent to draw from. Of those who talk appreciatively of "the I.M.E.A. exhibition," probably few, except as an afterthought, give due credit to the organising work of E.D.A. in this connection. The exclusion of the manufacturers from the constitution causes regret in some quarters, but as an offset I have heard from several in a position to know that the idea that the manufacturers have actually expected in the past to profit by the work of our propagandist body has caused some of the municipalities to stand out.



Mr. F. W. Purse has a quiet chat with the President

The only "private exhibition" I have been able to discover so far is that of the Hotpoint Co., which has an excellent display of domestic appliances right opposite the Westover Road entrance to the Pavilion, which is the hub of the Convention, unless the illumination of the façade of the Royal Bath Hotel by 36 400-W Mazda "Mercra" lamps may be regarded as an "exhibition" of modern floodlighting. This is being carried out by the B.T.-H. Co. in conjunction with the Bournemouth and Poole Electricity Supply Co., Ltd. This is the first time I have seen these lamps under working conditions, and the illumination of the white stone-work is most effective. The light is emitted from electrically excited mercury vapour at high pressure, and I am informed that the lamp gives 45 lumens per watt (compared with 15 lumens for the gasfilled lamp). Developments have been held up hitherto by the lack of a glass that would withstand the high temperature and high pressure. The spectrum is not that of daylight, but colour discrimination within certain ranges appears to be satisfactory.

Delegates "signing on"

The G.E.C. is floodlighting the Pavilion with 6-A 230-V discharge lamps of the type used to floodlight the Hop-Vine Hotel, Wembley, and its own research laboratories (already described in these columns). The red light, which is most effective, is obtained entirely from the colour of the gas, no tinted glass having to be used; it is said to have, in practical result, nearly seven times the efficiency of gasfilled lamps, due to the light absorption by the glazing required with the latter. An opportunity has been missed, I think, in not floodlighting the gardens adjoining the Pavilion, which is a very good way of displaying the merits of electricity and advertising the beauties of a seaside town.

A secondary topic of conversation has been the future organisation of distribution. Here again the common opinion is that some such move is necessary, but the tendency is to

" wait and see " what the ultimate official proposals may be.

Whatever may happen should not adversely affect the I.M.E.A., seems to be the view of most members, as larger distributing areas should enhance its position as a force within the industry. Regarding conventions generally, the idea of

Messrs. A. C. Cramb and H. C. Lamb

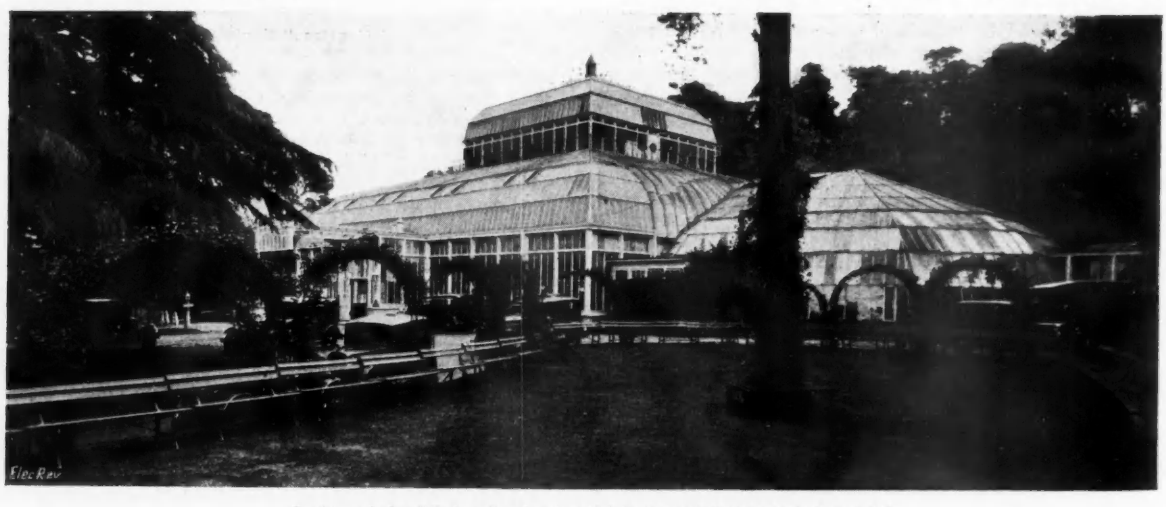
the one big electrical conference is undoubtedly gaining in favour, partly because its immense propaganda value is realised.

Advertising is one of the important questions of the hour among electricity supply men—as I ruminated upon these things nothing was more to my liking than to meet, wherever I turned, sandwichmen who bore (owing to the lowered temperature we almost said " 'mid snow and ice ") a banner bearing the device " THE ELECTRICAL REVIEW : The Newspaper of the Electrical Industry." Excelsior!

TUESDAY EVENING.

THE Convention opened last night at 8.15 with a reception by the President, supported by the Mayor of Worthing, in the Sun Lounge of the Pavilion. This was followed by a dance in the ballroom which continued until 1 a.m., when the number of couples in the hall appeared to me to be rather more than in previous years; possibly due to the relief to those tired with long journeys by an alternative cabaret entertainment in another part of the building.

The jet-changing and colour-changing fountains in front of the Pavilion provided another attraction. There one met for the first time this year many of the later comers perhaps for the first time since the last Convention and picked up threads where they were left at Cardiff.



A view of the Winter Garden in which the exhibition is being held

The first session was held this morning at 10 o'clock in the Concert Hall of the Pavilion. The civic welcome extended by the Mayor of Bournemouth (Coun. J. R. Edgecombe) was brief and to the point, but the cordiality of the open invitation to the delegates to take advantage of the many natural and planned amenities of the town was not to be mistaken. Mr. Porter then delivered his presidential address (reported elsewhere), which Ald. H. B. Vorley happily described as setting the tone for the furthering of the industry through co-operative action; Mr. H. C. Lamb expressed the views of the audience in his reference to the excellence of its writing. Its delivery was clear, and was aided by the good acoustics of the hall.

Static Sub-stations

While the ladies were taking coffee with Mrs. Porter, Messrs. E. Seddon and Mr. J. Eccles read an abstract of their paper on static sub-stations. The authors in stating at the outset that the subject matter would be treated as far as possible in a non-technical way made what appeared to me merely a formal recognition of the lay element of the Association. I mention this lest it should be thought by engineers who had not the privilege of reading or hearing it that it is of an elementary, superficial character. I only know how invaluable I should have found a similar collection of data when engaged on distribution problems. Mr. Lamb did well, however, to suggest that in some cases the switchgear layout was unnecessarily expensive, and also to dissent from the author's views regarding voltage regulation. A report of the discussion follows :—

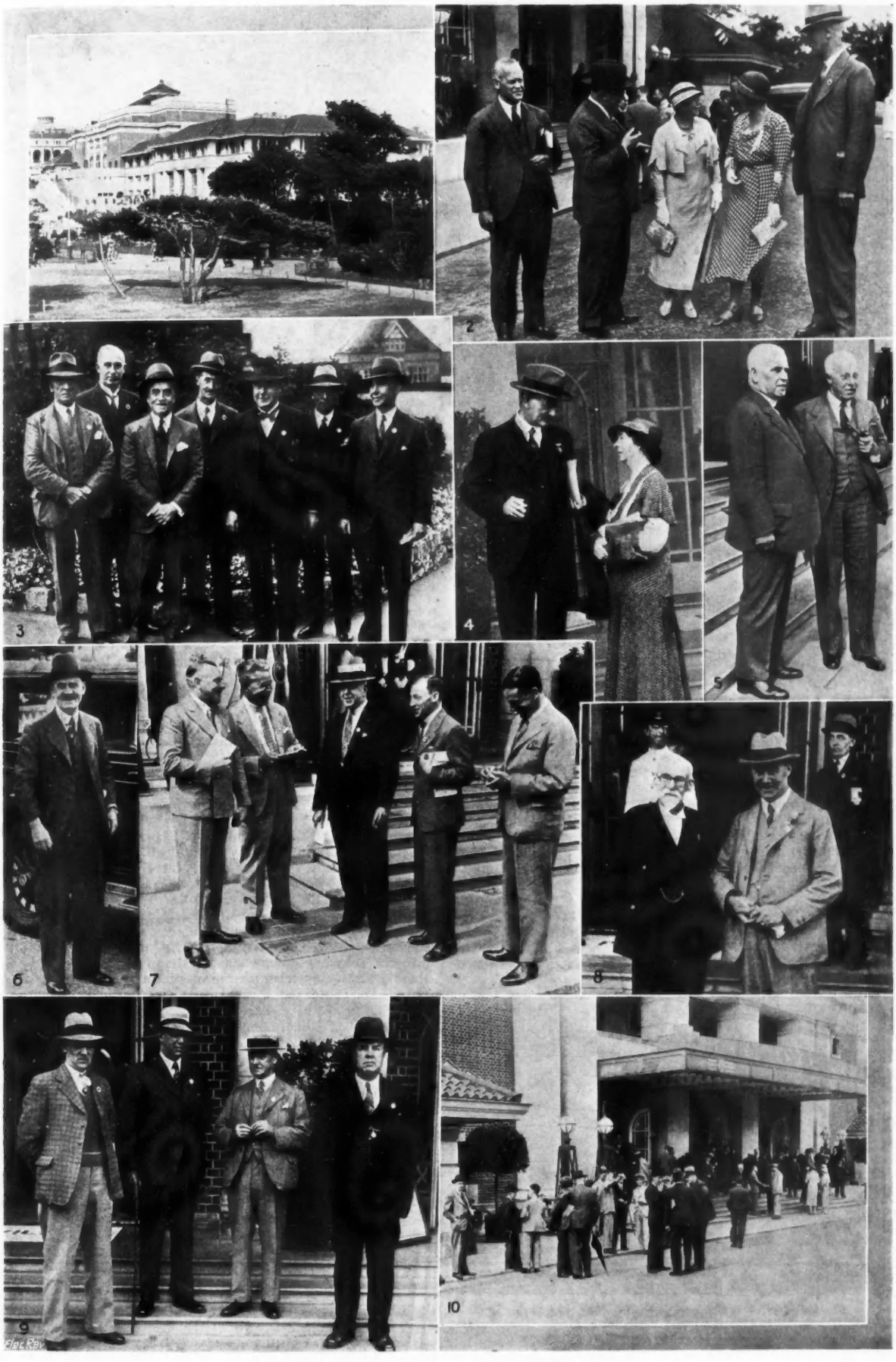
The paper was read by Mr. A. Eccles, and a series of lantern slides were explained by Mr. E. Seddon, after which Mr. H. C. Lamb opened the discussion. He said that it was many years since they had had such a paper. Expansion of distribution systems was much greater than consumption figures indicated; the systems now being laid out would last for many

The Pavilion floodlighted by Osira (G.E.C.) lamps

years. It was important that every undertaking should have compulsory powers to acquire sub-station sites. There was now a Bill before Parliament which sought to secure this power. Once they had obtained it there would be little necessity to make use of it because its existence would induce people to be more reasonable. In this connection it was also important to erect attractive buildings, for the appearance of the buildings had a considerable bearing on the subject.

The cost of switchgear was increased by what appeared to be the authors' elaborate layout. In view of present reliability, fuses could often be used instead of circuit breakers. Again, steel cubicle equipment was often cheaper than metal-clad gear. Referring to voltage regulation, he considered it would be a retrograde step to attempt to work to 8 per cent. instead of 4 per cent. It was easy to keep within the latter limit provided automatic regulators were used. The paper was a fine work of reference.

(*Continued on page* 842.)



Caught by our Camera at Bournemouth

1. The Pavilion from the gardens. 2. Mr. Sills, Mr. and Mrs. P. H. Symonds, and Mr. and Mrs. J. F. Simpson. 3. Messrs. F. Newey, H. Talbot, J. Mould, E. J. Nichols, A. J. Hutchinson, C. Hollander, and D. McDougall. 4. The President with Mrs. H. C. Lamb. 5. Messrs. A. W. Blake and R. W. L. Phillips. 6. Mr. J. R. P. Lunn. 7. Messrs. E. G. Batt, J. N. Waite, A. W. Barham, P. M. Maxwell, and A. M. Anderson. 8. Alderman J. B. Rapkins, J.P., and Mr. F. W. Purse. 9. Messrs. J. Hopton, W. A. Walker, W. H. Cooke, and Councillor C. W. Potts. 10. Delegates arriving for the opening session.

Mr. H. W. Swann, H.M. Inspector of Factories, discussed the legal aspects of the subject. He was glad to hear that when the Home Office Regulations were taken into account the resulting sub-station was an engineering job. Experience showed that this always occurred when the Regulations were taken into consideration at the beginning, but it was not always so when the structure had to be patched up to make it

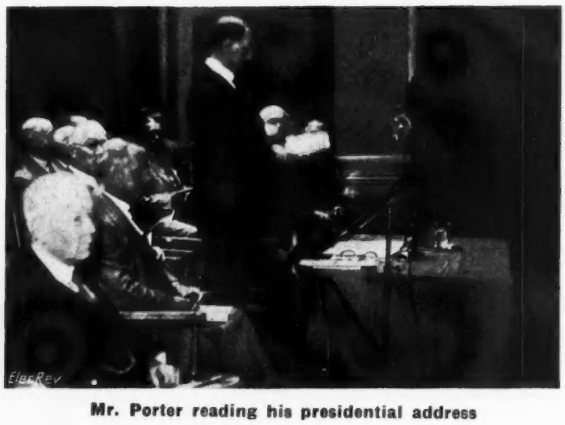
The I.M.E.A. Council

Front row: Messrs. J. W. Simpson (secretary), J. H. Rothwell (hon. solicitor), C. G. Morley New, G. Porter (president), P. J. Robinson (vice-president), W. C. P. Tapper (hon. secretary) and E. A. Barker (hon. treasurer). Second row: Ald. H. B. Vorley, Messrs. H. C. Lamb and J. D. Knight, Ald. W. Emmett, Messrs. F. Forrest, B. Handley, R. W. L. Phillips and E. E. Hoadley. Back row: Messrs. D. McDougall, A. S. Blackman, J. Mould, A. J. Hutchinson, E. J. Nichols, Councillor J. A. Mason, Messrs. A. W. Blake and F. Newey, Ald. R. Richardson and Mr. E. Seddon

comply. There was no legal definition of the term "occupier." Engineers and himself sometimes differed about its interpretation, but he thought the best guide was to use the term for one who transformed and sold energy.

With regard to Home Office Regulation 32; it was not clear what constituted "ample clearance" in underground sub-stations. He thought it was a suitable occasion to plead with the civic authorities present for better sites which would allow for further expansion. Such sub-stations could also be incorporated or combined with other public works. He thoroughly agreed with the authors' recommendation about the use of screens as a protection to outdoor sub-stations. With regard to earthing—whether it should be single or multi-point—the only way of ascertaining was by measurement of the fault current flow.

Mr. A. W. Blake (Willesden) pointed out that protection had an important bearing on the location and density of sub-stations. Specifications for sub-stations in the North of England appeared to be better than those for houses in the South. He favoured the use of chimneys rather than dutch in-walls for ventilation. He did not think the authors made sufficient



Mr. Porter reading his presidential address

use of the floor space, and their costs appeared to be higher than his own.

Mr. H. W. Clothier showed lantern slides illustrating switchgear tests. He spoke of the merits of metal-clad outdoor equipment, which he considered to be cheaper, apart from other technical advantages. Its use allowed money to be spent on equipment rather than on building. He drew attention to the importance of making as well as breaking capacity. The relation between the two was very important. He questioned whether a National Testing Station was desirable; a National Testing Committee might be useful, but a proving house already existed. A new establishment had been estimated to cost £200,000, with £60,000 annual upkeep. There was already in existence a suitable testing station in this country which could be made use of at a far lower cost than the figures suggested.

Owing to the lateness of time the authors reserved their reply to the discussions.

The Exhibition Visited

The afternoón was allocated to the official visit to the exhibition at the Winter Garden. This receives detailed consideration on another page, but the general impression I received was of a tendency towards the production of cheap yet robust apparatus to meet the limited purse. The space available struck me as most inadequate, but having regard to the restrictions imposed by this the exhibitors had displayed their goods attractively. The keenness of the manufacturers was demonstrated by the attendance at the stands of many principals of firms.

The interest taken by manufacturers in the Conventions is an important factor in their success, as their local connections enable them to bring together many municipal engineers hitherto unknown to one another. Inquiries of exhibitors showed that many regarded the opening day as the most successful for many years, particularly in view of the interest taken by the public in domestic electrical appliances. I heard that some 30,000 invitations to the exhibition had been sent out by the Bournemouth & Poole Electricity Supply Co., whose travelling exhibition van in the grounds caused considerable public interest.

The earlier part of the day was brilliantly fine, but showers at lunch and tea times served as a reminder that fine weather must be regarded as rather a special gift of the gods.

I was pleased to come across Mr. A. C. Cramb, for no convention of the Association would be complete without him after a lifetime spent in connection with electricity supply, including two and a half years as Director of E.D.A. He has been none too well for some time past; the strain of these high offices where so many different interests have to be reconciled, especially when so much time has to be spent running about the country to attend functions of all kinds and to induce authorities to provide more money, must tell on any man.

WEDNESDAY EVENING.

LAST night the Mayor and Mayoress of Bournemouth received the delegates at the Town Hall, after which dancing continued until 1 a.m.

The discussion in the lounge of the Royal Bath Hotel afterwards turned on the conclusions drawn by Messrs. Robinson and Handley regarding meat shrinkage. I must not anticipate points which are to be raised in the discussion to-morrow, but the experience of some engineers caused them to believe that under household working conditions electricity does cause

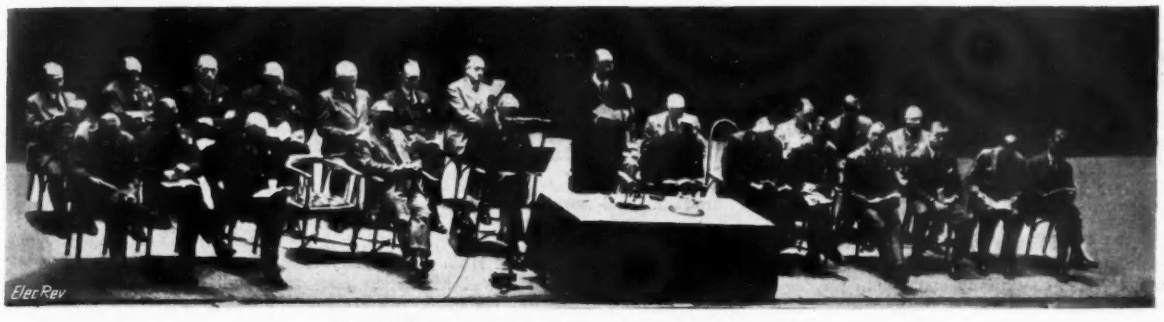
a saving. I hear that over one hundred took part in the Rotarian lunch on Monday. The Mayor of Heston and Isleworth rang up while I was dressing informing me that he had caught a ten-pound conger eel, and kindly invited me to call at his hotel to verify this.

Some disappointment has been expressed at the short time available for yesterday's discussion on sub-stations, but written contributions have been invited for publication in the annual report.

Rising early this morning and wending forth, I found that many other delegates had been tempted by the brilliant sunshine to do the same. Most of these were bathers, but I wanted to use the opportunity to see what electrical apparatus was on show in the town. Beale's in Christchurch Road had an effective domestic display by eleven electrical manufacturing firms—the British Vacuum and Engineering Co., Electrolux, British National Electrics, L. G. Hawkins, W. T. French and Son, Ediswan, Hotpoint, Beatty Bros., Foster Engineering Co., Simplex Electric Co., and Ferranti.

Later, news of a 74-passenger six-wheeled trolley-bus by the English Electric Co. and A.E.C. reached me, and I went to the tramway depôt. The bus has an 80-h.p. motor remote controlled with main contactors low down on the side and Lockheed braking. Its length is 30 ft.

After seeing the new vehicle I feel far happier regarding the future of trolley buses than I did a couple of years ago. There are two 60-seater buses of the same make, but heavier, on trial by the Bournemouth Corporation, and a third by the Sunbeam Co., with M.-V. motors, B.T.-H. equipment, and new demonstration chassis. I was particularly struck by the excellent state of the English Electric contactors after several months' heavy work in demonstrating the big bus.



The platform group at the opening of the Convention

Metering and Tariffs

This morning's paper was that on Metering and Tariffs by Mr. W. Lawson, of Birmingham (see page 849). The most important section is that dealing with the small domestic consumer. Some of Mr. Lawson's views are unusual, but refreshing, and the paper as a whole contains much sound sense. This Convention marks the fiftieth anniversary of the "Hopkinson" tariff. The Central Board's tariff is designed on the Hopkinson system, and therefore has at least a well-tried basis.

Mr. A. J. Howard (Taunton) opened the discussion by saying that simplicity was the ideal in tariff making. The suggestion that individual meter testing was necessary did not meet with his approval. He did not supply electric light until all gas was removed from the premises. He did not now use any demand indicators except in special cases. Meter men might soon become watch-makers. He considered that an alarm device was needed to warn consumers when it was necessary to place another coin in the slot meter.

Mr. L. L. Robinson (Hackney) favoured the use of the most simple prepayment meters and the collection of the fixed charge by the landlord. Ordinary collectors were too expensive and auxiliary devices on meters were a nuisance. The position would be hopeless unless the landlord collected the fixed charge. Could we not use simple prepayment meters with a few graded fixed charges and perhaps a minimum yearly payment? Complications must be got rid of as soon as possible.

Mr. A. W. Blake (Willesden) congratulated the author on his courage and logic. The Central Board Tariff, he said, would have to be modified to avoid hardship when a "snap" demand took place, chiefly on the domestic side where no maximum demand was in operation. He had reduced the unit cost of water heating by not charging rent after the first installation charge. He agreed with the author that a standard tariff would be very disastrous. Councillor W. T. M. Hughes (Hornsey) appealed for greater simplicity. Technical phraseology created mistrust in the consumer's mind. He failed to see why they could not quote a flat rate like any other industry which had similar difficulties to overcome. Every little irritation to the consumer must be removed.

Mr. W. M. Selvey (London) thought the real trouble was that the two-part tariff was not scientific; it was an unnecessary attempt at simplicity. The diversity was the governing condition and there were a number of diversities along the links of the chain so that no simple two-part tariff would ever represent the cost of electricity supply. Electricity was not a commodity—it was a service. If they attempted to equate the price to cost of production there must be an endless tariff. There was not merely one but many publics, each with different habits, and one service would not be acceptable to all. They must ask the consumer to pay for electrical service in the same way in which the consumer himself was paid; that is, weekly, monthly or annually. The ideal was to make a contract on the supposed needs and afterwards use the meter to determine the dividend or rebate to the consumer.

From left to right: Mr. C. G. Morley New, Mr. E. A. Barker, Miss N. D. Clothier, Mr. H. W. Clothier, Mr. W. C. P. Tapper and Mr. B. Thomas

Councillor A. T. E. Andrews (Abertillery) agreed with Councillor Hughes that most technical explanations were an evasion of something which would be unpleasant when expressed in plain language. Col. H. W. Watts (Epsom) said that he used the two-part tariff extensively; the only difficulty was the prepayment consumer and the need for a step rate or sliding scale, either of which would eliminate the trouble.

The President's Reception: Mr. and Mrs. W. C. P. Tapper, Mr. and Mrs. Porter, the Mayor and Mayoress of Worthing and Councillor and Mrs. J. A. Mason

Mr. H. E. Blackiston (Ipswich) suggested that the author's difficulty was the method of collecting two-part tariffs. It was obvious that many consumers would be of no use to the supply undertaking if they had a low flat rate for lighting offices and similar premises. In such cases the kW charge should not be reduced under any circumstances.

Councillor J. R. Potts (Carlisle) described a method applied to consumers of very limited means in Carlisle. Sixty-four houses had been supplied at a weekly cost of 4s. 4d., including rates, rent and electricity. The charge covered lighting only —3d. for electricity and 1d. for lamp renewal. No meters were used and the saving of £200 thus effected enabled a low charge to be made. Mr. A. S. Blackman (Sunderland) said that the discussion seemed to hinge upon prepayment meters, for which he had no use whatever. They were a danger and expensive. For very small houses, of which he had 2,500, ordinary disc meters were used (for lighting and an iron); the charge was 6d. for a certain amount per week, plus ½d. for excess consumption. The money was collected weekly and bad payers were punished by having a prepayment meter installed. Engineers seemed to have a habit of settling simple things in a complicated way.

Mr. W. Lawson, replying, said that they were aiming all the time at simplicity, but they must try in this case to get the best from each consumer. The demand for prepayment meters was increasing and, therefore, they were entitled to expect some reduction of price. The very small consumer could be dealt with in a special manner because his limited income fixed his consumption and therefore made him an ideal user. Anything which helped the consumer to understand the supplier's objects was worthy of careful study.

Mr. P. J. Robinson (Liverpool) proposed a vote of thanks, and Mr. A. E. Mackenzie (Wimbledon) seconded it.

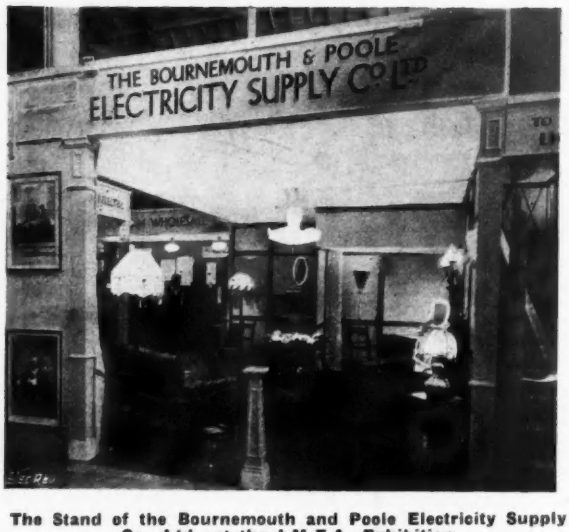
The Rest of the Proceedings

As this issue of the ELECTRICAL REVIEW will be in the hands of delegates at Bournemouth on Thursday morning, I can only look forward to the remainder of the programme. As will be judged from the review of the paper which appears on a later page, the views of Messrs. Robinson and Hoadley will arouse considerable interest, much discussion, and maybe a little dissent, and so we can rely on having a good morning. Dr. Denham is to talk candidly about rural problems in the afternoon. So much food for thought during the day may not be a suitable prelude to the annual dinner to-morrow (Thursday) evening, but I expect to see everybody there.

Delegates to the Convention

The list of those who are taking part in the Convention includes the following well-known names:—

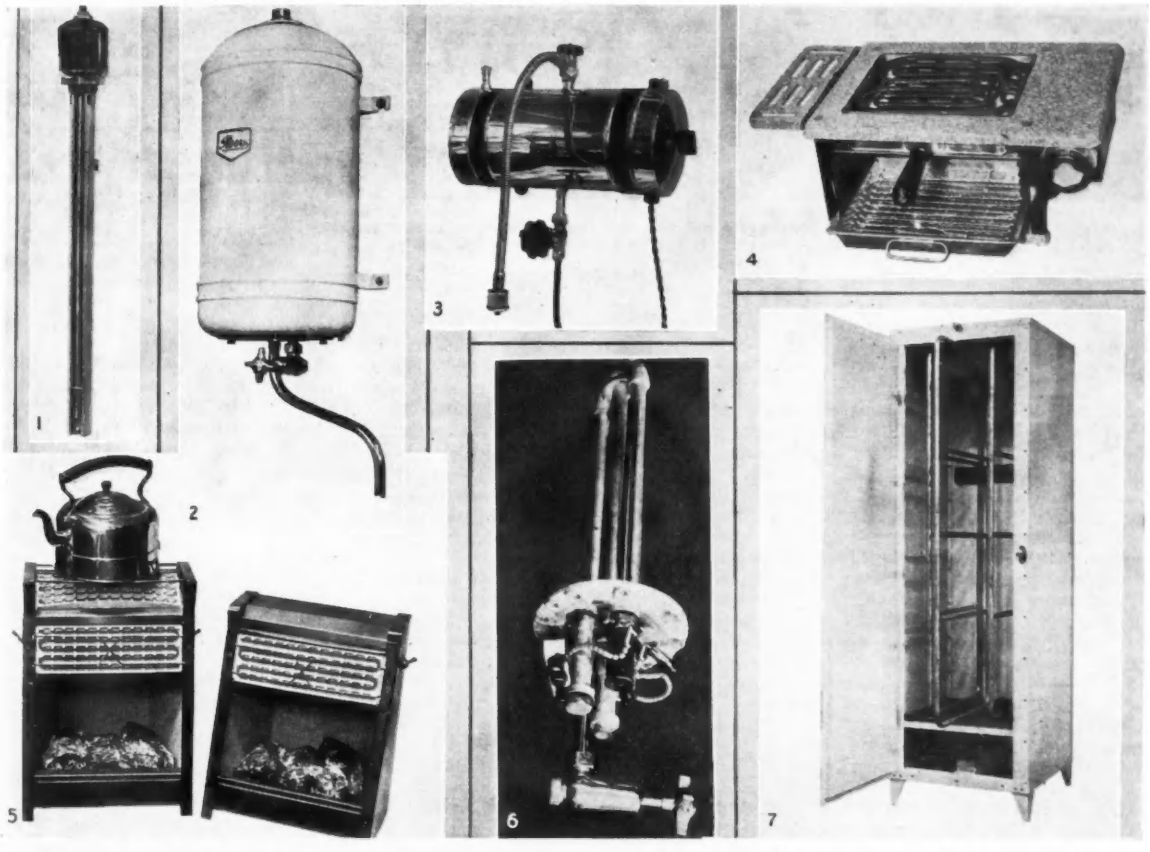
A. J. Abraham (Bexley Heath); D. G. W. Acworth (G.E.C.); H. Adam (Seaham Harbour); J. E. Adam (Paisley); C. F. Adams (C. Bray & Co.); W. E. Affleck (Guildford); A. Albrecht (E.W.F.); S. T. Allen (Central Elec. Board); R. Amberton (Elec. Apparatus Co.); E. A. Anderson (Walton-on-Thames); H. W. Angus (Eccles); H. E. Annett (Bolton); A. Aspinall (Brighouse); H. A. Aston (J. A. Crabtree & Co., Ltd.); L. B. Atkinson (C.M.A.); F. Ayton (Ipswich); R. Ayton (Winchester); W. J. Bache (Cheltenham); E. F. Bacon (Holmfirth); A. W. Barham (Watford); E. A. Barker (Barnsley); G. E. Barlow (Belliss & Morcom, Ltd.); J. A. T. Barnes (Kendal); E. G. Batt (G.E.C.); J. W. Beauchamp (Central Elec. Board); Capt. A. J. Beckett (Bridlington); J. Beckett (Municipal Tramways & Transport Association); W. E. W. Beerling (Brit. National Electrics, Ltd.); Maj. H. Bell, O.B.E. (Glasgow); J. Alex. Bell (Aberdeen); C. R. Belling (Belling & Co.); H. H. Berry and R. Berry (Berry's Electric, Ltd.); W. C. Bexon (Ayrshire Elec. Board); A. Bishop (Buxton); D. H. Bishop (Dundee); H. Bishop (Falkirk Iron Co.); H. E. E. Blackiston (Ipswich); A. S. Blackman (Sunderland); A. W. Blake (Willesden); T. Bloore (Sutton Coldfield); R. A. R. Bolton (Allan West & Co., Ltd.); F. A. Bond (Battersea); Dr. Edward Bowden (Enfield Cable Works, Ltd.); J. M. Bowman (Rhondda); T. G. Bradley (Bulpitt & Sons, Ltd); W. D. Brassington (Motherwell); H. Breckell (Gainsborough); P. V. Brittlebank (Johnson & Phillips, Ltd); S. E. Britton (Chester); G. Broadhurst (Clacton-on-Sea); E. Brook (Brook Motors, Ltd); Sir John Brooke (Electricity Commission); E. Brunt (Todmorden); J. K. Brydges (Eastbourne); C. W. Buckley (Santon, Ltd.); G. C. Burnand (London Elec. Wire Co.); H. R. Burnett (Barrow-in-Furness); J. W. Burr (Swansea); H. Burrows (I.R.G.P.Co.); H. C. Busbridge (Swinton); F. S. Button (W.E.S.); A. Q. Carnegie (C. A. Parsons & Co.); H. F. Castle (Bridport); J. V. Chaplin (Colwyn Bay); John Christie (Hurlingham); H. Alex. Clarke (Neath); A. C. V. Clarkson (G.E.C.); A. W. Clegg (Accrington); P. Clegg (Morecambe); S. Clegg (Lincoln); T. M. Climie (Falkirk); W. N. C. Clinch (Brighton); H. W. Clothier (A. Reyrolle & Co.); C. A. Coleman (Turton); O. G. Cook (Bingley); W. H. Cooke (Luton); N. B. Coop (Brit. Elec. Meters, Ltd.); A. G. Cooper (Thornton Cleveleys); W. J. Cooper (Hamilton); F. H. Corson (Gloucester); H. T. Cort (Brush Elec. Eng. Co.); H. Couzens (Westminster); Alex. C. Cramb (E.D.A.); V. W. Dale (E.D.A.); J. C. Dalton (Prov. Elec. Supply Assocn.); T. E. Daniel (Ashton-



The Stand of the Bournemouth and Poole Electricity Supply Co., Ltd., at the I.M.E.A. Exhibition

Mr. A. J. Fuller (past-president) with Mr. J. W. Simpson (secretary)

under-Lyne); B. Darby (Atherton); C. S. Davidson (Barnes); D. H. Davies (Chesterfield); H. C. Day (Heywood); H. A. Deacon (Cryselco, Ltd.); Dr. H. J. Denham (Oxford); H. H. Denton (Crewe); A. J. C. DeRenzi (Newcastle); J. R. Dick (Lucy & Co.); G. P. Dixon (Colchester); C. H. Dobell (Radiovisor Parent, Ltd.); Capt. J. M. Donaldson (North Met. E.P.S. Co.); J. G. Doran (Bermondsey); W. H. Duffett (Rotherham); Sir A. R. Duncan (Central Elec. Board); Mrs. H. Dunkerley (Bridlington); J. Eccles (Edinburgh); James Edgar (South Shields), W. Thomson Edgar (Horstmann Gear Co.); J. E. Edgecombe (Kingston-on-Thames); P. M. Edinborough (Automatic Elec. Co.); E. A. Edwards (Simplex Elec. Co.); F. H. Edwards (Dartford); F. F. Elliott (Woolwich); W. H. Elliott (East Ham); J. E. Ellis (Morley); E. Ellwood (Manor Elec. Oven & Fire Co.); G. J. Evans (Pontypridd); J. C. Fairchild (Lytham St. Annes); Capt. G. F. Falk (Falk Stadelmann & Co., Ltd.); J. B. Feltham (Mexborough); A. E. Felton (Revo Electric Co.); S. Ferguson (Ferguson, Pailin); V. Z. De Ferranti (Ferranti, Ltd.); W. K. Fleming (Rothesay); F. M. Fletcher (Darwen); F. Forrest (Birmingham); J. S. Forster (Crook); F. J. Foster (Siemens Bros. & Co.); S. H. Fowles (Heston & Isleworth); O. F. Francis (Kirkcaldy); H. G. Fraser (Oxford); J. A. Fraser (Carron Company); Wm. Frisby (Colchester); A. J. Fuller (Fulham); Chas. Furness (Blackpool); F. Garside (Aldershot); S. Cameron Gibson (Nuneaton); W. A. Gillott (English Elec. Co.); J. Gilmour (Daniel Adamson & Co.); Lt.-Col. H. Gordon-Luhrs (Domestic Elecn., Ltd.); Geo. E. Green (Geo. Green & Co.); C. E. D. Greenhalgh (Ilkley); G. F. Gregory (Ilford); R. W. Grubb (Dewsbury); R. H. Gummer (International Combstn., Ltd.); J. W. Hadfield (Barnstaple); Harry Haigh (Shipley); H. Hall (Gillingham); T. Hall (Burton-on-Trent); B. Handley (Portsmouth); R. C. Harpur (Dover); A. F. Harris (Nalder Bros. & Thompson); M. M. Harvey (S. W. & S. E.P. Co.); Miss C. Haslett, C.B.E. (E.A.W.); L. P. Haussauer (Aidas Electric, Ltd); A. M. Hawkins (L. G. Hawkins & Co.); B. T. Hawkins (Wallasey); R. J. Hebbert (Ferranti, Ltd.); C. Nelson Hefford (Leeds); H. J. Herrera (Risca); E. Holcombe Hewlett (Mansfield); R. L. Hewling (Skelton and Brotton); T. W. Hibbert (Doncaster); W. T. Hilder (Haslingden); W. Hill (Burnley Components, Ltd.); W. C. B. Hillman (Caerphilly); E. E. Hoadley (Maidstone); Frank Hodges (London); Major L. B. Hogarth (Whitehaven); C. Hollander (English Elec. Co.); (Wimbledon); G. C. McLean (Inverness); N. McLean (Harrogate); Lord Meston (London); W. H. Metcalfe (Bacup); Miss N. Miller (E.A.W.); A. E. Mills (M. K. Electric); E. A. Mills (Halifax); Geo. C. Milnes (Lancaster); C. O. Milton (Maidenhead); D. R. Moffat (Moffats, Ltd.); K. A. Scott Moncrieff (Prov. Elec. Supply Assen.); A. Nichols Moore (Newport); E. Morgan (Sheffield); R. J. Morris (Edison Swan); The Rt. Hon. Herbert Morrison (London); M. J. Mortimer (Loughborough); John Mould (Leicester); C. F. Mounsdon (Sevenoaks); E. Moxon (Southport); E. K. Muir (J. H. Tucker & Co.); A. M. Mulliner (Middleton); F. G. Nesbitt (Simplex Elec. Co.); H. A. Nevill (Peterborough); C. G. Morley New (Cardiff); E. S. New (D.P. Battery Co.); F. Newey (Long Eaton); P. Newnham (C. A. Parsons & Co.); F. Nicholls (Derby); E. J. Nichols (York); A. Nicklin (Swindon); Geo. Nicolson (Weymouth); John A. O'Brien (Redcar); F. L. Ogden (Oldham); G. H. Oldroyd (Stockport); Sir Archibald Page (Cent. Elec. Board); H. H. Parker (Pudsey); Wm. A. Parker (Workington); B. Alex. Pask (Norwich); L. C. Penwill (Elec. Contractors' Assen.); J. W. Perkins (Foster Engineering Co.); T. Petersen (Callender's); R. W. L. Phillips (Bedford); A. Pickersgill (Spenborough); H. C. Pierson (Met. Vickers); J. W. Piggott (Whitby); Chas. Pipkin (Callender's); A. D. Pluck (Congleton); G. Porter (Worthing); R. B. Potter (Simon-Carves, Ltd.); J. G. Potts (Bury); Fredk. W. Purse (London); M. J. Railing (G.E.C.); H. Raine (Annfield Plain); W. R. Rawlings (London); W. E. Rawlinson (Hotpoint); F. N. Rendell-Baker (Croydon); C. Garfield Richards (Port Talbot); A. J. Richardson (Hawarden); E. K. Richardson (Tilbury); G. E. Riley (B.T.H.); A. S. Rinder (Metropolitan-Vickers); W. H. Robins (Stafford); I. V. Robinson (B.E.A.M.A.); L. L. Robinson (Hackney); P. J. Robinson (Liverpool); J. N. Robertson (B.E.T. Co.); J. W. Rodger (Bruce Peebles & Co., Ltd.); T. Roles (Bradford); L. Romero (Salford); A. E. Roots (Dumfries); J. H. Rothwell (Brighton); F. E. Rowlands (G.E.C.); Wm. A. Royle (Blackburn); F. H. Rudd (Rochdale); W. F. Russell (Lichfield); A. J. Ryan (Hastings); P. E. Rycroft (Great Yarmouth); C. W. Salt (Carlisle); R. H. Scotson (Middlesbrough); Jas. Scott (Formby); E. Seddon (Edinburgh); W. M. Selvey (London); R. O. Seville (Wakefield); C. M. Shaw (Worcester); C. E. C. Shawfield (Wimborne); T. S. Shenton (Rugby); J. E. Shepherd (Rawtenstall); J. H. Shepherd (Harwich); J. S. Simmons (Henley's); J. F. Simpson (Preston); B. Sleath (Venner Time



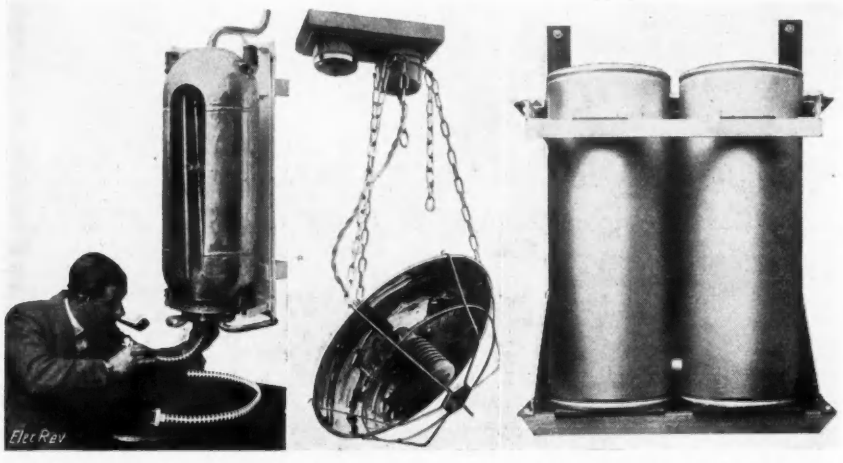
1. The new "Heatrae" circulator unit with thermostat outside the casing. 2. A new 1½-gall. "Revo" water heater. 3. Shower bath heater (Santon). 4. The British National breakfast cooker with "Backer" element. 5. New Carron imitation-coal fires. 6. The element and thermostat of the "Revo" heater shown at (2). 7. The improved "Tresco" clothes dryer ("Ediswan")

G. J. Hollyer (Torquay); E. C. Holroyde (Crompton Parkinson); J. Hopton (Normanton); A. J. Howard (Taunton); J. Snow Huddleston (United Telephone Cables, Ltd.); J. B. Hudson (Leigh); S. C. Hurry (Jackson Elec. Stove Co.); A. J. Hutchinson (Farnworth); R. Illingworth (Poplar); C. W. Jackson (King's Lynn); W. A. Jackson (West Bromwich); W. F. Jackson (G. Bray & Co.); E. J. Jarvis (Scarborough); E. J. Jennings (Birmingham); A. C. Johnson (Southend-on-Sea); W. S. Johnston (St. Helens); C. M. Johnston (Shrewsbury); Ben Jones (Bedwellty); E. W. Jones (Mountain Ash); J. T. Jones (Gellygaer); W. E. Jones (Basingstoke); W. J. Jones (E.L.M.A.); B. Kelly (Douglas); P. Kelly (Edison Swan); T. A. Kerr (Stretford); W. E. Kidner (Barking); T. A. Kingham (Kingston-upon-Thames); D. M. Kinghorn (Southwark); J. Kirby (Johnson & Phillips, Ltd); J. Douglas Knight (Ealing); A. E. Knights (Bury St. Edmunds); Wm. C. Knowles (Elland); G. H. Lake (Nottingham); H. C. Lamb (Manchester); J. Lambert (Perth); H. Large (Stoke Newington); E. T. Lawson (A. Reyrolle & Co.); W. Lawson (Birmingham); J. Leadbeater (Hampstead); R. Lee (St. Pancras); B. E. Leeson (Switchgear & Cowans); Frank E. Lewis (Canterbury); W. P. Lilwall (Fleetwood); H. A. Lingard (B.T.-H.); R. E. Livesley (Newark-on-Trent); B. S. Lord (Cleethorpes); D. W. Low (A. Low & Sons); E. P. Lucking (George Ellison, Ltd.); J. Harwood Lumsden (Stalybridge & Dist. Elec. Bd.); J. R. P. Lunn (Darlington); W. M. Lydall (Yorkshire Elec. Trans. Co., Ltd.); A. P. MacAlister (Islington); R. V. Macrory (Londonderry); W. D. Madden (Hick, Hargreaves & Co.); Professor Marchant (Liverpool); T. A. G. Margary (Wolverhampton); Harry Marsden (Honley); W. J. Marston (Coventry); T. D. Martin (Nelson); T. R. Martin (Birmingham); M. S. Mason (Worksop); F. V. L. Mathias (Warrington); Percy Marsh Maxwell (Batley); W. R. May (Lowestoft); D. McDougall (Greenock); C. F. McInnes (Gravesend); A. E. McKenzie Switches); Ch. Hubert Smith (Electric Fires, Ltd.); R. Smith (B.E.T. Co., Ltd.); R. W. Smith (Drake & Gorham Wholesale); W. J. Smither (Dorchester); C. H. Smyth (St. Marylebone); W. V. Smythe (Skipton); G. Sommerville (Faversham); G. E. Soulsby (Tanfield); J. W. Spark (Bath); F. E. Spencer (Birkenhead); G. R. Spurr (Walthamstow); Chas. H. Stagg (Eston); J. E. Starkie (Burnley); D. J. Strutt (B.T-H. Co.); C. W. Sully (E.L.M.A.); H. H. Sutcliffe (Hebden Bridge); M. G. S. Swallow (Richardsons, Westgarth-Brown Boveri); F. Swarbrick (Hove); F. H. Symonds (English Elec. Co.); C. D. Taite (Manchester); H. Talbot (Godalming); J. E. Tapper (Beckenham); W. C. P. Tapper (Stepney); W. S. Taylor (Mersey Cable Works); Bertram Thomas (Bertram Thomas); Dawson Thomas (Abertillery); T. S. Thomas (Bedwas); J. H. Thompson (Colne); A. H. Todd (Clitheroe); P. Tonks (Revo Elec. Co.); R. N. Torpy (Tunbridge Wells); J. W. J. Townley (West Ham); T. G. Travis (G.E.C.); W. G. Trend (Bromley); J. B. Tucker (J. H. Tucker & Co.); H. A. Tulloch (Leek); C. Turnbull (Tynemouth); W. A. Turnbull (Aylesbury); Capt. C. J. Turner (Hoylake); J. W. Turner (Huddersfield); W. G. Turner (Southampton); T. N. Veitch (Hague & McKenzie); Cdr. W. A. Vignoles (Chiswick); J. N. Waite (Hull); D. D. Walker (Evershed & Vignoles); W. A. Walker (Kettering); E. A. Ward (Siemens Elec. Lamps); A. J. Waring (Felixstowe); P. Wardle (Cannock); Lt.-Col. H. W. Watts (Epsom); H. Webber (Keighley); Allen West (Allen West & Co.); J. Wetherell (Leyton); Price F. White (Bangor); F. H. Whysall (Belfast); T. Wilkins (Penybont); G. Wilkinson (Harrogate); H. Wilkinson (Radcliffe); D. J. Williams (Mynddislwyn); F. H. Williams (Jackson Elec. Stove Co.); J. C. Williams (Erith); J. W. Williams (Wrexham); R. Willis (Cheadle); H. Wilson (Ashford); S. R. Windle (Grimsby); C. J. Wood (Sale); E. D. Wootten (Malvern); C. H. Yeaman (Stoke-on-Trent).

Impressions of the Exhibition

From Our Special Representative

AT Scarborough a couple of years ago I saw reason to report that there was "not quite the same zeal in pushing water-heating business as there is with regard to cooking supply." The position is now different. Not that there are many more equipments on show at Bournemouth; indeed, ignoring newcomers into the water-heating field, I am not sure that I have not seen fewer actual models this year. I think, however, that efforts have been made to grapple with difficulties from both the production (coupled with price) and the consumer's points of view.



Mr. N. F. Amery inserting a flexible element in a new Charlton heater; the "Reybowl" ceiling radiator; and a "Unity" double-cylinder container unit for a rectangular heater

To see an element, two feet or so long, inserted vertically at the bottom of a heater, with only eight inches clearance below the cylinder, impressed me. I refer, of course, to the new "Charlton" heaters of Johnson & Phillips, Ltd., but I understand that in a new immersion heater and circulator introduced by Ferranti, Ltd., flexible elements are employed. The horizontal or vertical element question seems to be almost settled, for I saw very few of the horizontal type.

The element of the new heater displayed by the Revo Electric Co., Ltd., is specially designed to prevent sagging. Nichrome resistor is staggered round the special porcelain bobbins. Berry's Electric, Ltd., have also taken measures against sagging elements. I have not heard many grumbles in this connection, but everybody is annoyed with scale and silt, and on this score I think Revo have a good scheme. A special draw-off tap on the heater-unit flange enables the whole container to be flushed out frequently.

This company's combined immersion heater and thermostat mounted on one flange is similar to several units that I saw, the manufacturers of most of which stressed the advantage of quick fixing. I am sure that to stress the resultant cheapening to the consumer would have much more effect.

One good contribution towards cheaper installation, by the way, is an idea launched by Electric Fires, Ltd. It is to insert between the cold-water tap and the pipe a "Heatrae" tee-piece to which copper pipe with a cone connection is fitted. Mr. Knight told me that an overall saving of 25 per cent. can be made in this way, as against a lead-pipe plumbed system. The new "Heatrae" circulator and thermostat combination is a very compact affair. It has loadings up to 4 kW and the whole is served by a standard 2-in. threaded flange unit. But what appealed to me most was the arrangement of the thermostat outside the sheath, in a recess in the latter.

There is yet another interesting "Heatrae" development—an external hot- and cold-water mixing valve. And I saw a similar device on a barber's tank introduced by Archibald Low & Sons, Ltd. This 3-gal. tank is loaded as high as 2,000 W.

I saw for the first time a side-entry, *i.e.*, horizontal, circulator and thermostat combination ("Highlow"). The main body is slightly on the slant, pointing upwards; an insulated hot-water outlet tube projects upwards from the end of the element casing in which there is a cold-water inlet hole on the under side at the flange end. Mr. Duncan Low considers that circulators are of no use where the water is hard.

Preventing Waste

Because of my conviction that the progress of electric water heating has been retarded tremendously by hot-water wastage, I strongly approve the principle involved in a "Heatrae" hot-water prepayment apparatus. A definite quantity of hot water is obtained from a filled tank sized according to the electricity rate.

Santon, Ltd., reported increased sales of their geysers in spite of the undertakings' dislike for the heavy loadings. I saw another geyser-like apparatus, too, shown by Domestic Electrification, Ltd. The general structure is similar to the storage tank (rectangular and plated in this case), but the circulator principle is employed and the loading is 3 or 4 kW. Hot water is drawn from inside the casing around the elements.

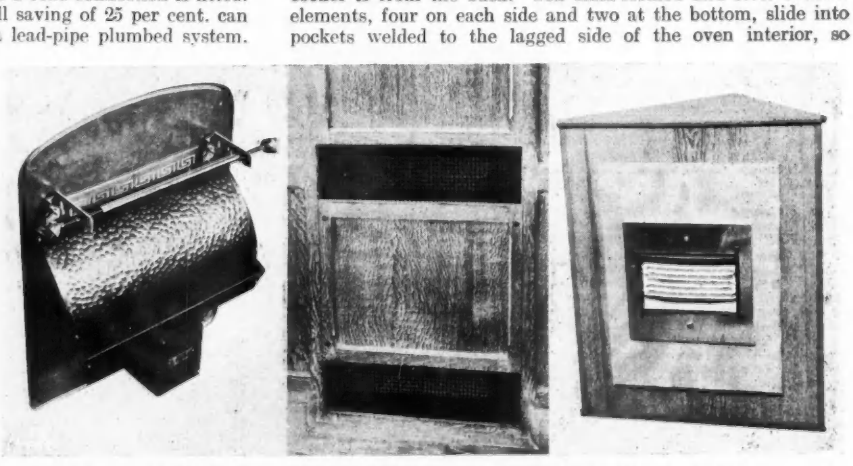
I shall look forward to criticisms from some "supply" quarters of the heat insulation idea "put over" by Automatic Electric Co., Ltd. An ordinary cylinder is wrapped with six layers of corrugated cardboard. But it is a contribution (I think an important one) towards cheaper installation. And it looks quite nice covered.

I saw only one twin-cylinder container scheme for overcoming pressure trouble with rectangular equipment; this was shown by Barker, Young & Co. The "Unity" and "Charlton" heaters seemed to be the only patterns in which the weight is not carried by the outer container. The top entry element and thermostat unit in the new equipment shown by George Green & Co. seems to offer an excellent means of defurring the elements.

New Cooker Ideas

The most revolutionary scheme that I came across in connection with cooking equipment involves the application of the bain marie principle to domestic cooking by the Manor Electric Oven & Fire Co. Elements very deeply welled in the cooking chamber are surmounted by the recessed and enclosed roasting pan (or cupboard) and utensils. It seems to me that the captive heat around the saucepans must make for higher efficiency. I asked what about pastry cooking, and was told that a special open bottom utensil to fit into the roasting-pan space was under way.

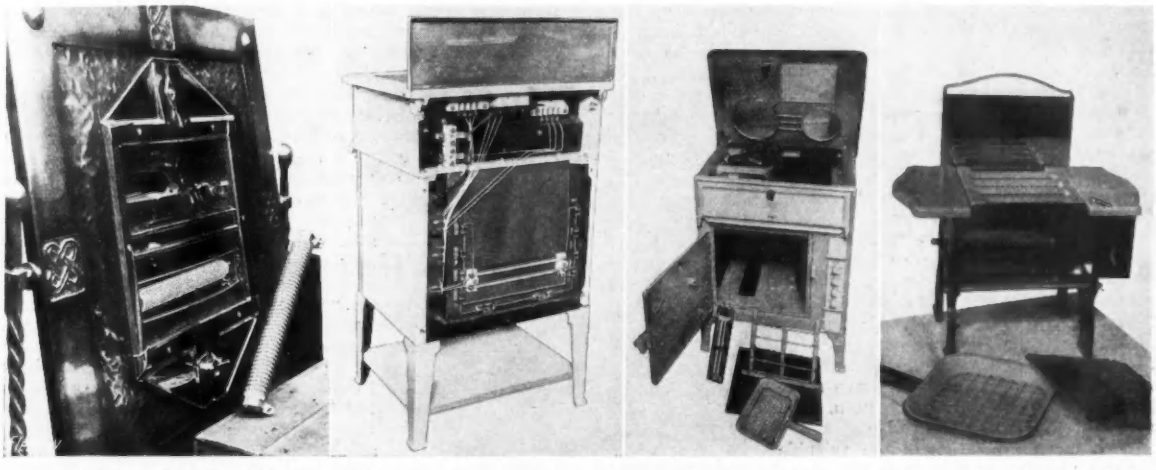
The idea of a fixed oven without inside elements has made a step forward since I first saw it at Birmingham in February. The only way to get at the oven elements of the new Belling cooker is from the back. Ten mica-formed and steel encased elements, four on each side and two at the bottom, slide into pockets welded to the lagged side of the oven interior, so



A fire with an adjustable suspension rod to fit any fireplace (Automatic Elec. Co.); a "P.H." convector fitted in wall panelling; and a Berry "Magi-panel" fire.

that the lagging surrounds the pockets. In one of the new cookers introduced by British National Electrics, Ltd., the original scheme is adopted, but the elements are accessible from the side. Only one removable side or back piece tends to cheapen construction.

Some of the makers told me that they were unhappy about plug-in element units, but I saw more than ever. Alignment and corrosion seem to be the biggest troubles. Bellings have made a bold bid to get over them by equipping the hob units of the new cooker with switch-type contacts. The contacts



From left to right: The Bulpitt fire with special element connections; back view of the new Belling cooker showing slide-in "exterior" elements; the construction of the new Siemens cooker; and the Jackson combined breakfast cooker and fire

are much heavier than is usual with plug-in connections, and the units can be lifted out at any angle.

I was very surprised to see so many red-hot sheath boiling plates on cookers of all makes. Most of them are optional, but many are standard. Undoubtedly they afford quicker first boiling, and that appeals to the householder who has no electric kettle. I saw "Backer" plates (Metropolitan Vickers Electrical Co., Ltd.) on Carron cookers and "Chromalox" plates (George Bray & Co., Ltd.) on several other makes. Then, of course, there are the "Torribar" (Hotpoint Electric Appliance Co., Ltd.), "Cookquik" (Moffats, Ltd.), and the Manor Co.'s radiant plate.

I have seen for the first time an embedded heavy solid type boiling plate which runs red hot (Simplex Electric Co.).

The only open plates that I saw, excluding the Belling boiler-griller and breakfast-cooker plates, were on some of the "Tricity" models of British Electric Transformer Co., Ltd. They are *really* open plates, with grid bars not over the elements but over the spaces between them. On a new Manor cooker I saw something new in boiler-grillers. Recessing the fireclay slabs into the under side of the casting adds to the efficiency by the elimination of air insulation.

Most of the new cookers I have seen—Magnet, Revo, Siemens, etc.—have simple lift-out hob-unit supports, a movement started by the Jackson Electric Stove Co., Ltd., a couple of years ago, I believe. The General Electric Co., Ltd., considers that the usual small cooker is too small, so the new "Magnet 333" has two 1,800-W hob units and is still within the 21 in. width which builders are allowing in small houses.

Heating Systems

To me the most interesting thing about the general space-heating equipment display is the certain increase over previous years in the low-temperature equipment on view. The various panels shown by Barker, Young & Co., Ltd., the tubes by almost every exhibitor of fires, and the convectors by Greene, Phillips & Co., Ltd., all indicate the correct principle, wholly or in part, of electric room heating.

There are other ways. "Raytonic" fires manufactured by the Manor Oven Co. seem to have open-type elements for projection, scientifically designed apertures for convection, and the heavy surround apparently has limited thermal-storage qualities.

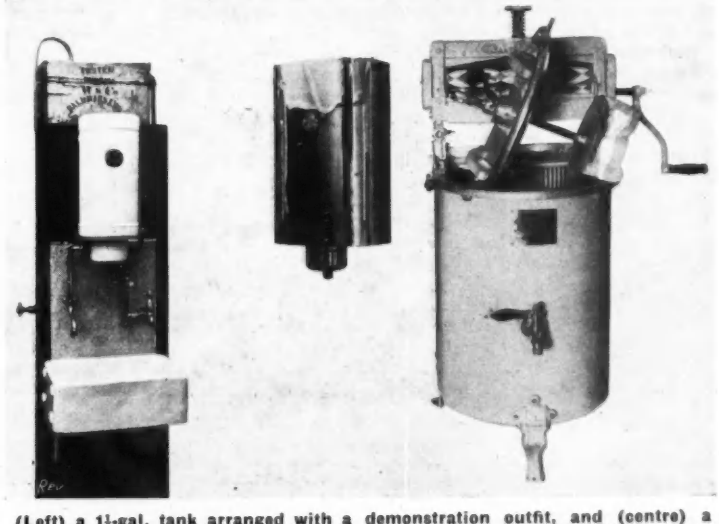
I confess that I have never before regarded the flush-front radiant-type fire as a convector. But Mr. Leevers, of the Edison Swan Electric Co., Ltd., spoke convincingly on this point when describing to me a new pressed-steel fire with a dished front which is offered at 16s. This company's representative also showed me a prepayment meter and fire with the meter at the back. When one pays for warmth he does not want to sit looking at the meter.

Inset and panel fires are obviously in favour; some I saw, Bellings, for instance, which just hang on to the box at the back. This company has some with "tiled" surrounds of treated cast-iron. I was certainly deceived.

Among the latest imitation-fuel developments are a realistic Carron "fuel" which is almost as light as paper, unbreakable, and non-inflammable; two sets of vaned wheels revolving in opposite directions, so eliminating regularity and affording a jumping-flame effect, fitted to a new "Xcel Cosyglo" fire; and a combined imitation-log and coal "Revo" fire.

Fire makers also seem to have their plug-in troubles, and Bulpitt & Sons, Ltd., and Automatic Electric Co., Ltd., both interested me very much in this connection. In a rod-type reflector fire shown by the former company the spiral over the porcelain rod is taken round the screw between the head and the end clip and twisted back on itself. There are thus two connections in parallel at the vital point. This connection is permanent, and the clip is bolted to a flexible bracket fixed to the end of the reflector trough, so allowing for expansion.

The Automatic Electric Co. showed me a fire with ordinary 25-A phosphor-bronze switch contacts which receive heavy cupro-nickel knife contacts on the ends of the element rods. Another "Xcel" scheme which impressed me was a provision for hanging an inset fire on to a bar made to fit any fireplace.



(Left) a 1½-gal. tank arranged with a demonstration outfit, and (centre) a geyser-type heater, both by Domestic Electrification, Ltd. (Right) the "Burco" wash boiler with hand agitator and wringer

I cannot recall having seen one refrigerator. That is a pity, for refrigerator business is growing. Wash-boilers abound, notable examples of which I saw displayed by Burnley Components, Ltd. This company's representative mentioned an idea which will probably be marketed in tangible form soon. It concerns a hot-water circulator for conversion schemes; the hot water issuing from the top of the circulator is definitely controlled according to its temperature by a bi-metal valve.

The Presidential Address. By Geoffrey Porter, A.M.Inst.C.E.

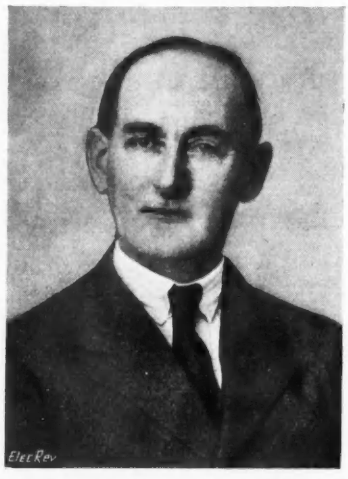
LONG experience has demonstrated the wisdom of entrusting the general management of electricity undertakings to their chief engineers. The confidence which the latter have been able to gain has seldom been misplaced, and from the earliest days of municipal ownership of electricity supply undertakings it has been the practice to regard the electrical engineer as the chief executive officer, subject, of course, to a general control by his committee.

In recent years there has appeared a deplorable lack of appreciation of the professional aspect of the engineer's position. From this arise such evils as insufficient remuneration; the appointment of unsuitable men; the view that municipal service is a career for third-rate men alone; and, what is a most unhappy development, the active discouragement by their experienced seniors of promising recruits. Within recent months it has proved impossible to secure the services of a fully competent principal assistant when the salary offered was attractive and the ultimate prospect of advancement good.

Electricity Supply is a Business

It is lamentable to observe frequent neglect to appreciate the fundamental difference between the status of a great trading department of a municipal body and the departments that exist to regulate the general convenience of the community. There is an ever-increasing claim on the part of the financial departments of local authorities to assume control.

With due appreciation of the valuable services rendered by the financial officer, his training and his habit of mind do not, as a rule, fit him to take care of the business side of an electricity supply undertaking. This embraces far more than the laborious, but comparatively simple, operation of collecting accounts and preparing a balance sheet. Business and technique in such undertakings are too closely interwoven to permit of separation.



Mr. Geoffrey Porter, the president of the I.M.E.A., is borough electrical engineer of Worthing

A recommendation to the Council of the Institute of Municipal Treasurers and Accountants to approach the Ministry of Health with regard to the extension of costing systems *to other services* may relate to the setting up of a standard system of costing and audit by which the multifarious and complicated returns that burden the life of the financial officer and his staff may be reduced to some workable common denominator. If that is the essence of the recommendation no one need be disturbed. But it may go further, and the electrical engineer administrator may find himself shorn of an important part of his prerogatives.

The ramifications of our industry with its numerous interests have called into being a large number of voluntary organisations. One of the difficulties of the present time is to co-ordinate their activities. In the face of foreign competition the policy of B.E.A.M.A. has proved, in the main, productive. In quarters where fierce competition was formerly the rule the economic struggle has been turned from methods of defence to attack. The decision to establish the I.M.E.A.-B.E.A.M.A. Committee taken several years ago has proved to be wise and is in the best interests of the I.M.E.A., which represents a very large purchasing power in the electricity supply industry. Given the necessary authority to establish a central purchasing organisation, much might be done to increase the volume and reduce the prices of the commodities required to carry on the supply of energy.

Although E.D.A. is hampered by an insufficient subscription list, and also, to some extent, by the numerous interests it is obliged to conciliate, it has done exceedingly valuable work to promote an electrical atmosphere throughout the whole country. Local authorities who do not subscribe, or whose subscriptions fall short of the standard scale adopted by E.D.A. must be persuaded and, if no response to persuasion is forthcoming, must be brought into line by statutory regulation.

The object of the British Electrical and Allied Industries Research Association is not so much to cheapen production and thereby to reduce prices to buyers—though this result does in fact occur—as to eliminate weaknesses and to improve and to substitute something better for what may be standard at any time. To this end the most complete co-operation of all interests must be assured. The cost of maintenance, repair, and renewal, far outweighs the difference in the relative prices of a good and inferior article.

The continuance of a sufficient flow of money to enable such organisations to continue their work for the benefit of industry presents a serious problem. The system of voluntary support is stretched to breaking point. At present there seems no alternative other than a resort to compulsory subscription within the industry. This method would require legislative action. The statutory regulating authorities might conceivably be given power to impose the necessary regulations.

The work done by the British Standards Institution is of the highest importance to the fortunes of the whole Empire. The title and number of the specification are all that need be mentioned in a contract; this is an immense achievement.

Compulsory Wiring Regulations?

With regard to the proper equipment of homes, at the present time local powers are inadequate. What is urgently needed is the issue by the recognised authority—in this case the Electricity Commissioners—of a code of regulations agreed in all respects by the interested sections of the industry, which shall have the force of by-laws—enforceable under penalty. Such a code need not lead to vexatious inquisition by the local authority; indeed, anything of the kind would be fatal to progress. If, in addition, the registration of persons who undertake installation work were made compulsory a very desirable step forward would be made.

The I.M.E.A. is represented on twenty-six voluntary organisations. Its representatives on the panels, sub-committees, and committees of the British Standards Institution alone number about sixty. The same individuals appear in the composition of all; the strain imposed upon these "key" men is severe, and the time occupied away from their normal occupations very considerable. It is open to question whether an inconsiderable number of persons should continue to take so large a part in the industry's government.

The capital expenditure of the Central Electricity Board has been so enormous that the finances of the Board have been arranged upon a ten years' basis. It is an urgent need that these initial ten years should be devoted to an intensive and combined effort to increase the demand upon the Board's resources. This effort will call for a large aggregate expenditure of capital and might be intensified were the obligation imposed upon supply authorities (local), so to regulate their charges as to produce a balanced account annually to be relaxed during the development period. But the impetus required calls for something more positive than local regulation. A reorganisation of distribution and management can be the only effective method of stimulation.

Static Sub-stations

Paper read by Messrs. E. Seddon and J. Eccles on June 13th

THE full title of this paper is "The Design, Equipment and Operation of Static Sub-stations." The authors commence by pointing out that the concentration of generating plant in a relatively few large stations, while divorcing many engineers from generation, is introducing them to new problems in transmission and distribution, demanding a high degree of technical skill and administrative ability.

Various regulations prescribed by the Electricity Commissioners are somewhat out of keeping with modern practice, and could, with advantage, be revised to give greater freedom to supply engineers without diminishing the safety of the public or endangering the sufficiency of supply. It may be that in future some unification of the regulations for promoting the safety of the public will be possible, so that a common code will be issued either jointly by the Electricity Commissioners and the Home Office, or simply by the latter. It seems a little redundant for two statutory authorities to cover the same ground.

The authors indicate by means of a series of examples some of the main structural features of modern well-designed static sub-stations, and comment on lay-out and equipment. The

actual costs of existing sub-stations show the expenditure which must be faced under present-day practice in providing centres of a.c. distribution. In spite of the relatively high cost of brick buildings, it is felt that for urban distribution in a climate such as ours they still form the most satisfactory enclosure and, except in special circumstances, they are not likely to be replaced by steel kiosks or out-door structures.

The design of transformers appears to have reached finality in general principle, though this cannot be said of switchgear. The size and cost of e.h.p. switchgear is still too great, and improvements in design which will reduce both without endangering the safety of supply are an urgent necessity. The provision of a national testing plant would greatly conduce towards this end. The cost of this plant should be shared by the supply authorities and the manufacturers. Oil-immersed medium pressure switchgear for heavy-current service is also too expensive.

Voltage Regulation and Protection

One of the most difficult problems to which many supply engineers require to direct their attention is that of voltage variation at consumers' terminals. Technically this problem may be satisfactorily solved by any one of several methods, but it is a matter of considerable economic difficulty to provide all supplies within the statutory limits of voltage variation.

The time has arrived for voltage-drop regulations to be reviewed with a view to increasing the permissible medium voltage variation. An upper limit of 8 per cent. would be advantageous to the distributor without serious detrimental effect on consumers' apparatus. With regard to the use of voltage regulators, where unreasonable expense is entailed, such refinement is not justified.

The relatively few faults that occur on modern well-designed 11- and 6.6-kV systems raises the question whether all the precautions which are taken to ensure the continuity of supply are economically justifiable. The authors are of the opinion that a simplification of lay-outs will be the tendency of the future; but apparatus of sufficient rupturing capacity to meet all foreseen requirements should always be installed. Brief reference is made to the salient features of protective devices in general use.

The paper includes lay-out and circuit diagrams, and tabulated cost data. The three well-defined types of high-voltage switchgear are commented upon. The truck type is somewhat cheaper than metal-clad switchgear, while the cubicle type is cheaper than either of the others. Draw-out metal-clad m.p. switchgear costs more than non-drawout; open cubicle and slate-panel types are cheaper still, while open link-fuse gear costs less than the enclosed cubicle pattern.

The authors feel there is some merit in the proposal that a limiting flux density should be specified by transformer users. They suggest 11,000 lines per sq. c.m. as the maximum density in any part of the iron circuit unless and until a quality of iron is produced with much higher permeability than present-day values at and above this density. One effect of this change would, no doubt, be a slight increase in first cost, but it would improve the general performance and losses.

Up to 750 kVA one transformer is considerably lower in first cost than two of half the size, and two are cheaper than three for the same total rating; but for units of 1,000 kVA and over it may in some cases be a better proposition to install the larger number. Where two similar transformers are installed, the maximum integrated kVA over half an hour should not exceed 150 per cent. of the rating of one transformer. Similarly, for a three transformer sub-station the integrated half-hourly maximum load should not exceed 150 per cent. of the rating of two transformers.

[*Elliott & Fry* [*Balmain*

Mr. E. Seddon, M.I.E.E., M.I.Mech.E. (left) is city electrical engineer of Edinburgh and Mr. J. Eccles, B.Sc., A.M.I.E.E., is a member of his staff

The suggested loadings do not apply to transformers supplying a purely industrial load where the maximum is sustained for a considerable period, or to transformers in an isolated sub-station supplying a large e.h.p. network. Thus for normal distribution work it is suggested that a two-transformer sub-station may safely be loaded to 75 per cent. of the total rating, while a three-transformer sub-station may, with equal safety, be loaded to 100 per cent. of the total rating. On the larger sizes referred to above, the three-unit equipment will usually be cheaper per kVA of permissible loading when the transformer costs alone are considered, but the inclusion of switchgear and building costs reduces this advantage.

Electricity Metering and Tariffs

Paper read by Mr. W. Lawson, M.I.E.E., on June 14th

IN this country, whereas the tariff controversy has attracted the attention of supply engineers with never-failing regularity, metering has suffered comparative neglect. The meter engineer is concerned specifically with the measurement of those quantities upon which depend a correct rendering of accounts in accordance with prescribed tariffs. In this respect his responsibility is certainly onerous; but, though he does not devise nor is he responsible for instituting tariffs, he frequently has to explain and defend them, and thus is able to obtain the consumer's point of view.

The tariff controversy has not yet been finally disposed of, and in certain directions there is urgent need for reconsideration and discussion. The author is of the opinion that particularly is this so in the case of the domestic two-part tariff, about the future prospects of which he is in some doubt; and also as to what is the best tariff and meter to be adopted in developing further electrical services to the small prepayment consumer. To establish independent testing stations and put electricity meters on the same legal basis as gas meters would be a very costly arrangement. The most obvious way out of the difficulty is to arrange for official inspection of meter-testing departments, with occasional checks to see that the efficiency is maintained.

[*Elliott & Fry*

Mr. W. Lawson is special technical assistant to the city electrical engineer, Birmingham

In recent years great improvements in design and construction of a.c. meters have been introduced, affecting almost every detail. Prepayment meters are rapidly approximating to finality in design. The British meter, generally, is an instrument of very high quality, and there is evidence that the manufacturers are alive to possible future developments and quite capable of adapting themselves to new conditions and meeting the requirements of the supply industry.

The method of testing 90 per cent. of the meters used in the Birmingham Corporation area is by direct comparison with a standard meter. In five years the output increased 125 per cent., with only 25 per cent. increase of testing staff. About 700 high-voltage meters, with a revenue of more than half a million pounds annually, are maintained.

Until quite recently it was considered good policy to exchange all meters every five years, but with improved design and methods of manufacture increased reliability may be expected in the future. Probably the chief trouble is wear in the rotor bearing. There is now a real prospect of a solution of the problem being found, the British Electrical and Allied Industries Research Association having taken the matter up in earnest. The author has obtained remarkable results from diamonds, the use of which is justified in a.c. meters of 50 kW and upwards. For maintenance of low-voltage meters the number of visits to consumers' premises totals 10,000 per year. The maintenance and repair of prepayment meters is

both difficult and costly, and specially trained men are needed.

The Central Board's tariffs are based on the Hopkinson principle, and already there is evidence of fears that they will reveal the same drawbacks. It seems almost inevitable that they will have to be modified to avoid inflicting hardship when unforeseen conditions arise.

Domestic consumers are by far the more sensitive to changes of weather conditions. In the case of an undertaking highly

In the demonstration workshop of the Manchester Electricity Department. The Singer Sewing Machine Co. co-operates with Messrs. Sparrow, Hardwick & Co. in operating a conveyor system which completes a shirt in a minute. (See "The Power Canvass," page 868)

developed on the domestic side, but with small industrial load, it would be unfair that it should be penalised for a snap demand of this character, and unless some easement is forthcoming great care will have to be exercised in the development of domestic heating. The Central Board's summation method sounds rather a difficult proposition, but it is quite simple in principle, although the manner that has been selected for carrying it out with the numerous relays and moving parts required is distinctly complicated in detail.

The author has summated three and four supplies to large consumers in a much simpler manner and certainly at a much lower cost. The method involves the assumption that the loads are balanced. With large installations this has proved to be so nearly correct that in no case has the summator been more than 1½ per cent. out of step with the circuit meters over long periods of years. It is obvious, then, that at the station busbars from which a great variety of installations are fed, the assumption of a balanced load becomes an absolute certainty. The great advantage of the method is that the indications of the summator meters are not a mere echo of the circuit meters, but an independent measurement, and a constant check.

Is the Two-part Tariff Essential?

The two-part tariff has stimulated consumption in the domestic sphere, particularly that of lighting, but the fact remains that a considerable number of consumers in a position to avail themselves of the tariff do not do so, and one is led to conjecture whether history will not repeat itself and, after the manner of the Wright demand tariff, it will not find itself in a cul-de-sac of arrested development. There is a real danger in this possibility, and if the limitations of the two-part tariff are at all likely to be the cause of the slow progress in the domestic field, about which there are so many complaints, then the tariff should be overhauled. One of the advantages claimed for this tariff is that there is no need for separate circuits for lighting and power. There is not, in fact, much point in the argument because for proper protection and safety separate circuits are an advantage, and it is within the author's own observation that "all-in" tariffs encourage disordered and even chaotic wiring and the careless connecting up of apparatus.

From the supply undertaking's point of view, it is very desirable that the customer should pay a fixed charge, as it ensures some return for radio, small power and (in the case of a.c.) time services, which cannot always be adequately remunerated by a unit charge, the economical consumer being able to evade paying a fair contribution towards the cost of these services. Unfortunately, this is not the point of view of the general public, and this fact must be taken into account by supply authorities, amongst whom there is too prevalent a tendency to imagine that so long as the undertaking is assured of its fixed charges, all is well. Even so, the difficulty of assessing the running charge remains. If, for example, the rate is low enough to make, say, water-heating feasible, then it will over-stimulate the lighting and heating—both seasonal demands—and water-heating will languish. As no rate compromise is entirely satisfactory, free development must of necessity be hampered unless appropriate rates are devised involving additional circuits and metering. Too much insistence on the necessity of imposing fixed charges denotes a lack of entire faith in the ability of the commodity to sell itself and produce appropriate return.

The problem of increasing consumption and at the same time checking rank growths of demand still exists. A standardised tariff would have dire results on the industry. The increase in the cost of distribution relative to that of generation is a warning that we should be flexible in our treatment of the problems that arise. It has been the habit to consider system loading too much in the light of station load-factor improvement, and to neglect the load factor of distribution.

Psychological Considerations

From the many forms of meters available and the number of two-part tariff meters especially that have made their appearance, opinion on the manufacturing side seems to be ahead of that on the supply side, where there is much hesitancy. What is chiefly lacking is data of performance in practice of the various methods suggested. Those who advocate the use of any particular form of tariff should work out the technique of its application. The psychological factor must not be ignored. A tariff may be scientifically, commercially and officially right, but psychologically wrong. The author considers that the two-part tariff prepayment meter comes dangerously within this category and that its adoption should not be contemplated without the undertaking being assured that all the factors exist to make it acceptable to consumers.

The multiplicity of tariffs is not indicative of backwardness, but rather a proof of intensive efforts to circumvent the difficulties inherent in the sale of electrical energy; consequently there can be no such thing as an ideal tariff capable of universal adoption. If a tariff stands in the way of free and natural development, then it should be modified, however authoritatively it may be recommended.

The appeal factor of the two-part tariff is high because the consumer is enabled to raise his standard of illumination almost indefinitely at small extra expense—only the price of lamps is against him; and it might be expressed empirically as the ratio of the lighting consumptions before and after its introduction neglecting the effects of larger consuming apparatus.

The development factor may possibly be expressed as the ratio of the rate per kWh paid by the consumer and the basic running charge after a lapse of, say, five years. It can also be expressed as the ratio of the actual consumption per annum to the estimated ultimate consumption should full electrical services be made use of. The permanence factor may be expressed very inadequately as a ratio of normal consumption to maximum consumption.

The domestic two-part tariff appears to be lacking chiefly in the development factor, because of the fact that at the period of its introduction on a large scale, water-heating and heating on storage and semi-storage principles had not been envisaged; the difficulty of fixing a rate to include these was not anticipated. The additional stimulus of a low rate is needed to complete the effectiveness of the tariff and that a separate circuit and separate metering would be the best arrangement. The low rate should be applicable only to permanently installed apparatus, and all lighting and portable appliances should be connected to the circuit, the consumption of which is charged at not less than the normal rate.

Long-hour Loads

The portable electric fire is one of the cheapest pieces of apparatus obtainable and is a dangerous factor in producing peaks of demand during a cold spell and consequently should not be encouraged by offering an uneconomic rate. The permanently installed fire, particularly in a bedroom, is in a different category, making it permissible possibly to be allowed the low rate. In order to keep down abnormal demands, efforts should be made to introduce the principle of heat storage in cookers and heating apparatus generally, and this is only feasible with a low unit charge.

It is highly desirable that a fixed charge be imposed wherever possible, but every effort should be made to educate the public to appreciate that it is fully justified. Too much propaganda, however, might turn it into a political issue. It would be inadvisable to press it upon the small prepayment consumer, the electrification of whose home must of necessity be slow; nevertheless, all handicaps on development in this sphere should be removed. We should not await the advent of any great scheme of co-ordination of the distribution and sale of electrical energy—it is a chimera—but go out on the plan of selling cheaply where we can without loss, and of obtaining our price when we can rightly do so. The customer will then meet us half-way.

Electric Cooking, Domestic and Commercial

A paper read by Mr. P. J. Robinson, M.I.E.E., and Mr. E. E. Hoadley, M.I.E.E., on June 15th

ON the best possible grounds the authors claim that not only does electric cooking beneficially affect the system load factor, but that in addition it is more satisfactory than any other system of cooking, providing adequate supply mains and suitable maintenance arrangements are available. At least one boiling plate on each cooker should have the highest possible loading, and manufacturers should aim at producing plates of not less than 2,500 W loading.

There is scope for considerable research on the part of manufacturers, and if they can produce a cheap and reliable plate which will boil three pints in nine minutes, or two pints in six minutes or under, gas cookers would have very little chance compared with electric. The authors' tests indicate that the shape of the utensil has a considerable effect on the time of boiling, and they are carrying out further experiments.

Elaborate tariffs confuse the consumer. The most satisfactory is a straightforward two-part tariff in which the fixed charge represents the cost of lighting, and the cost of cooking may be based on the kWh rate. When the cost per kWh does not exceed one-tenth of the cost per therm of gas, electricity will easily compete with gas on the score of cost; when it is below one-twelfth there will be an appreciable saving.

Tests which were carried out by the authors show that there is no great difference in the loss of weights by either method, and that conflicting views are due to differences in temperature of gas and electric ovens during the tests. The only advantage of electric cooking with regard to loss of weight is that there is less likely to be a departure from the initial temperature setting as compared with gas cooking. Consequently there is a greater possibility with gas cooking of an increase in the percentage loss of weight after a cooker is once installed. In general, the costs of energy, which include the initial heating-up of the oven or grill, are appreciably higher for gas than for electricity.

Electricity Consumption in Cooking

Regarding the consumption of energy for cooking, figures ranging from 1.25 to 2.2 kWh per person per day have been put forward in all good faith, and it appears that much depends upon the habits and circumstances of the individuals in the various households.

Tests of a heat-storage cooker showed that it had certain advantages, but the lady who carried them out reported that "considerable planning of the domestic routine was necessary to obtain satisfactory results, and it is doubtful if the cooker would prove popular in the face of serious competition from gas, especially in view of the fact that grilling was impossible and the making of toast unsatisfactory. At the same time, a cooker of this type would be a great boon in a rural area as compared with a coal range or a coal range and oil cooker."

In presenting her report this lady did not consider in any way relative costs, and it is quite possible that, in some cases, the low rate at which this cooker could be hired out, because of the low maintenance costs, also the low rate at which electricity could be supplied because of the high load factor, might prove very attractive and outweigh the disadvantages associated with the careful planning of domestic routine referred to. In addition, for rural work, where voltage drop would prevent the installation of the usual type of cooker having a loading of 8 or 9 kW, such a cooker would have a very definite advantage.

Kettles and Water Heating

The cost of repair of electric kettles is a large proportion of cooker maintenance charges, in many cases from 20 to 25 per cent. Some undertakings provide a plain type of kettle with their cookers to be used on the boiling plates, whilst in other cases an additional hire charge is made for electric kettles.

From the consumer's point of view there is much to recommend a small thermostatically controlled water heater in the kitchen or scullery supplied with water from the fresh water tap. This heater, usually having a capacity of 1¼ gal. and a loading of 750 W, ensures a supply of water at about 190 deg. F. being always available and very much reduces the time taken to boil water for making tea or boiling eggs. The gas undertakings have copied this system, but the relative safety and cleanliness are such that there is no comparison between the two systems.

Incidentally, the use of a small electric water heater of the type described considerably reduces the energy consumed where the main cylinder of the house is electrically heated, with thermostatic control. This saving is due to the cutting out of the loss of heat from the hot water left in the supply pipes from the main cylinder every time hot water is drawn from the tap in the scullery.

That the effect of a cooker load on the system load curve is beneficial is well established, and this, of course, assists materially in the reduction of selling costs, due to the improvement in load factor. The usual number of cookers installed in a large undertaking is from 4,000 to 6,000, which means a possible maximum load of 42,500 kW, but the increase of load due to the installation of cookers in such undertakings is rarely more than about 8,000 kW, in itself an off-peak load, so this type of load has very considerable diversity.

A very interesting test which supports the foregoing statement regarding diversity was carried out some two or three years ago on the supply to a housing area having 257 all-electric houses supplied from one sub-station. The electrical equipment in each house consisted of the following:—Cooker, water heater, wash boiler, two radiators, linen cupboard heater, and nine lights (thermostatically controlled). The weekly maximum loads for the group were as follows:—

	kW.	Peak time.
Saturday	414 ...	12 noon and 1 p.m.
Sunday	703 ...	1 p.m.
Monday	372 ...	12.15 p.m.
Tuesday	372 ...	12.30 p.m.
Wednesday	372 ...	12.30 p.m.
Thursday	372 ...	12.15 p.m.
Friday	296 ...	12.30 p.m.
Saturday	414 ...	12 noon and 1 p.m.
Sunday	703 ...	1 p.m.

Annual consumption—1,433,269 kWh.

As the loads on Saturday and Sunday do not require special plant to carry them, the load factor may be calculated on the maximum load occurring during the week, which is about 44 per cent. The average price obtained is 0.668d. per kWh.

The authors acknowledge their indebtedness to Mr. J. N. Waite (Hull) for similar data obtained from an estate of 500 working-class residences, and to Mr. F. E. Spencer (Birkenhead) for curves of domestic loads for a fairly considerable area, largely rural, which show that the peak is well away from the peak of any average undertaking whose output includes a considerable proportion of industrial load. These support the author's own experience that the diversity due to domestic load is extremely high, and that due to cooking load is higher still; consequently it is possible to give these supplies profitably at a very low cost.

In large towns where gas is priced at 7d. or 8d. per therm the running component of a two-part tariff should not exceed 0.75d. for reasonable development. The fixed component should be "measured at the time of the system maximum demand." When it is from £3 to £8 per annum for houses ranging to the ordinary middle-class dwelling and the kWh

[*Elliott & Fry*

Mr. E. E. Hoadley is borough electrical engineer of Maidstone, and Mr. P. J. Robinson city electrical engineer of Liverpool

charge is 0.5d., no loss is incurred by the average large undertaking.

Cooker load development is almost entirely dependent upon efficient maintenance service, and great care should be taken in the choice and training of maintenance men.

This paper is full of valuable data, and figures relative to costs, cooking tests, loss of weight of meat cooked, equipment installed, apparatus and system loadings, typical consumptions and boiling plate tests, while figures obtained from a recent installation will act as a guide to the results likely to be obtained from commercial cooking in clubs, hotels, institutions, &c., as distinct from domestic installations.

The Farmer and Supply Undertakings

A paper read by Mr. H. J. Denham, M.A., D.Sc.,* on June 15th

THE object of this paper (the full title of which is "The Needs of the Farmer and the Responsibility of Supply Undertakings") is to show how the municipal supplier can obtain access to the rural area outside his present boundaries, and what demand he may reasonably expect to find, or, more probably, create for his supply. In many instances this can be done by judicious extension of the area of supply by a series of "fringe orders."

To avoid unnecessary complication, it is advisable to obtain general consent for a specified area from the local authority, and a similar general consent from the supplier or undertaker in whose area it is proposed to operate. It would appear, unfortunately, that the Electricity Commissioners require a detailed schedule of the individual premises which it is proposed to supply. This may be given in the form of a list in the first instance, and, apparently, premises may be included whose owners or occupiers have not specifically applied for supplies; but a separate application to the Commissioners will have to be made for any new premises which are erected after the order has been obtained.

Simultaneously with the centrifugal penetration of the countryside by town workers there is a centripetal movement of the more intensive forms of farming towards the town. The poultry farmer, the market gardener, the fruit grower, and the nurseryman, in particular, must be regarded as potential users of electricity; and the remarkably successful results which have been obtained, for instance, by the Shropshire Company in South Wales, by the Chester Corporation in North Wales and Cheshire, by the Aylesbury Electricity Department in Buckinghamshire, to cite only a few instances, have not been due to any special set of circumstances, nor to the existence of a cheap rate, but to individual enterprise.

Engineers should be capable of meeting the farmer on his own ground, and it is essential that they should be given some measure of freedom to arrange each case on its own merits. It is quite impossible to secure and retain subscribers under rigid "head office" control, insisting on an inflexible schedule of tariffs and connection charges. In too many districts of England this rigidity of outlook, and the remote control of activities which can only be dealt with by men with knowledge of local conditions and power to act on their own initiative, is rapidly creating a situation which may eventually necessitate intervention by the Commissioners and the transfer of areas to other than their present suppliers.

The Need for Demonstration

A farmer rarely asks for electricity without previous solicitation by the supply undertaking. This is not due so much to lack of enterprise as to ignorance of the cost and capabilities of electric power as applied to his own needs, and it is in the variability of these two items that the crux of the whole problem lies. Electrification will never attain to its proper place in the agriculture of this country until these charges can be unified on a national basis.

The farmer must be interested. Although a well-stocked showroom is a very great asset it is not enough. The farmer in general needs to see the equipment which he is likely to use at work, earning its keep, under practical farming conditions. The luxury demonstration farm, over-equipped and under-stocked, is useless for the purpose, and it is better to make an arrangement with some local farmer, well known in the district as a sound man, to allow his equipment to be inspected when at work, in exchange for certain assistance in the matter of the original installation, with possibly a small commission as an added inducement to the conversion of proselytes.

The dairy is the most promising of all branches of farming activity for future development. In addition to driving the dairy machinery, there are useful applications of electricity for water heating and steam sterilising equipment. This is a field in which there are clearly defined possibilities for off-peak and night-load arrangements, and should be capable of great expansion in the near future.

Electricity is par excellence the solution of pumping problems and offers the advantages of ease of control (with or without automatic regulation), silence and compactness in a combination that no other source of power can provide.

In Poultry Farming

The use of electricity in poultry farming may be unhesitatingly recommended, and the applications are many. The risk of interruption of supply has, in the past, proved a serious deterrent to the use of electricity in this brand. Such reports as have come to hand this season show that this risk has been exaggerated. In the mammoth incubator the loss due to several hours' interruption of current is negligible, except at periods when a hatch is in progress, when heavy mortality may result, not from chilling, but from suffocation, due to the stoppage of the circulating fans. The risks, in any case, may now be covered by insurance; but, in any event, when it is necessary to cut off the current temporarily for alterations to lines and equipment, this should be done only after consulting such poultry farms as are connected to the system.

In general, while there are many subjects which may be discussed with advantage with the habitual user of electricity, it is bad policy to attempt to introduce to a client new to the virtues of electricity any application which is in the remotest degree experimental. Farming, to be successful, must be done on strictly business lines, with its expenses as carefully controlled as they are in any other manufacturing process, and the "intangible assets" which form one of the main claims for the superiority of electricity over other forms of power must be demonstrated to the farmer, just as they must be demonstrated to the industrial user, as clear and tangible results, before he will be willing to scrap existing equipment. A slight saving of convenience or labour is of little importance at a time when agricultural labour is still low-priced by comparison with that of the more favoured urban population.

* Director of the Institute for Research in Agricultural Engineering, University of Oxford.

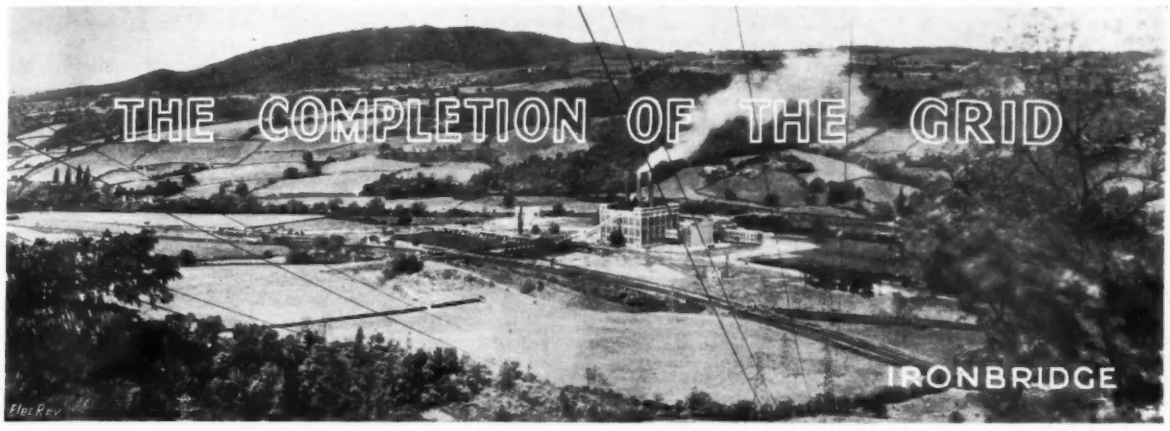
The President-elect

MR. PERCIVAL JAMES ROBINSON (whose portrait appears on page 851), who will follow Mr. Geoffrey Porter as president of the I.M.E.A., is Liverpool's city electrical engineer and lighting engineer. He is a man of Kent, as he was born at Erith in 1879. Following his electrical apprenticeship, Mr. Robinson studied at the Finsbury Technical College, and is among those who owe much to the influence of Professor Silvanus Thompson at the outset of their professional careers. That he profited immediately from this training is shown by his success in gaining the City of London Guild's diploma for electrical and mechanical engineering and chemistry.

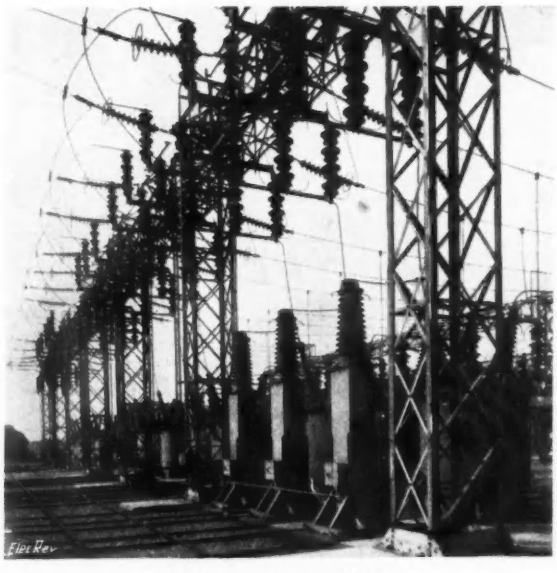
Mr. Robinson was engineer and manager of the Garston and District Electricity Supply Co., Ltd., until that undertaking was taken over in 1902 by Liverpool Corporation, when he joined the staff of the Electricity Department. He was appointed to his present position in 1928, on the death of Mr. Harold Dickinson. In addition to being responsible for the control of the undertaking, which covers an area of over 100 sq. miles, he carried out the design of the Clarence Dock power station, which is laid out for an ultimate capacity of 400,000 kW on a unique site. During the first four months of 1933 it generated a little over 90 million kWh, with a maximum demand of 54,440 kW. The average thermal efficiency during this period was 25.98 per cent., which we believe to be the highest yet recorded in this country for a steam station.

In spite of the especial severity of trade depression in Lancashire the electricity sold during the year ended March 31st, 1933, advanced by nearly 5 per cent. to 207 million kWh, while the number of consumers increased by nearly 12 per cent. to 81,960. This result Mr. Robinson attributes to the extended use of electricity for domestic purposes, a field that is being vigorously developed with the aid of a progressive policy in regard to the hiring of electrical apparatus. By the end of last month the numbers of the major domestic appliances out on hire were: cookers, 5,861; water-heaters, 350; wash-boilers, 186; and fires, 205. The scheme of hire and maintenance for the last three items was introduced only at the beginning of this year, and the total figure of apparatus connected is very much larger. An assisted wiring scheme has been in operation since November, 1929. Up to date the number of connections under this scheme has been about 9,500, of which nearly 3,600 are new this year.

Mr. Robinson is a member of the Institutions of Electrical and Mechanical Engineers, and an hon. member of the Society of Civil Engineers of France. He is also a member of the National and North-West England Consultative Committees of the Central Electricity Board. We tender to Mr. Robinson our congratulations on the honour to be paid him next month, when the Senate and Council of the Liverpool University will confer upon him the honorary degree of Master of Engineering in recognition of his work for the city.



THE national grid has been referred to as the hub of our industry. The desirability of all who are even remotely interested in electricity supply acquiring a general understanding of its functions is obvious, but paragraphs which appear from time to time in the lay Press indicate that many who seek to instruct others are without the most superficial knowledge of the position. The grid was put into commercial commission at the beginning of this year, but in two areas only (Mid-East England and Central Scotland), and the completion of the whole articulated system is not expected for a month or two yet. The Central Electricity Board, which is responsible for the construction of the grid and will continue to be responsible for its operation and financial future, was set up under the Electricity (Supply) Act, 1926. Its members, appointed by the Minister of Transport, are Sir Andrew Duncan (chairman), Lord Barnby, Sir James Devonshire, Mr. Frank Hodges, Alderman W. Walker, Sir Duncan Watson, Sir Ralph Wedgwood, and Mr. W. K. Whigham. The Board raises its funds by means of public loans, and is entitled to call for a Government guarantee in respect of its stock, but it has not applied to the Treasury for such a guarantee of any of its issues. In all other respects it works as a public company and not as a Government department.



Switchgear at Northfleet

The Central Board's Duties

The main duties of the Board are: (1) to concentrate the generation of electricity in a limited number of the most efficient stations and to control their operation; (2) to arrange for the extension and alteration of existing selected stations and for the construction of new stations by authorised undertakings when necessary; (3) to interconnect selected stations with one another and with the systems of authorised undertakings; (4) to standardise frequency with a view to effective interconnection; and (5) to supply, directly or indirectly, any authorised undertaking requiring electricity at a tariff designed to cover the Board's expenses over a term of years.

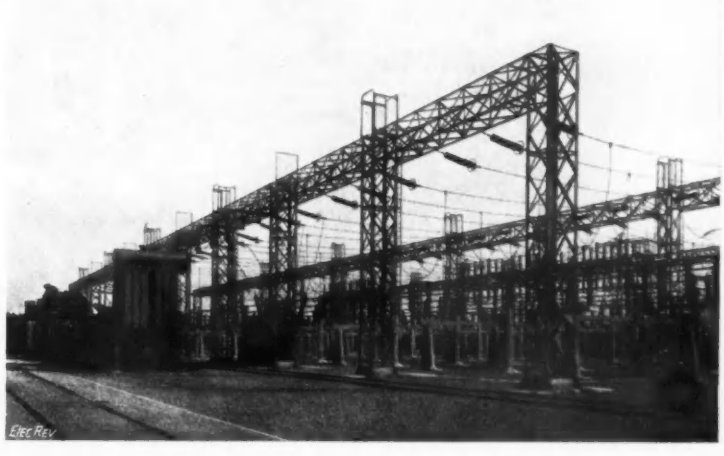
The grid consists essentially of 3,000 miles of 132-kV, 1,000 miles of 66-kV or lower-voltage lines, some experimental 132-kV cable sections, and 273 main transforming and switching stations. The generating stations selected for operation number 119, and sixteen more are to be built by authorised undertakings in the near future. During the construction of the grid bulk supplies were given to a number of undertakings to avoid expenditure on generating plant that would no longer be required when the grid was in being. The whole output of the selected stations will be purchased by the Board at the cost of production, which includes operating expenses, rents, local rates, management, and general establishment charges, together with interest (within prescribed limits) and sinking fund charges.

The Board has consulted representatives of the owners of selected stations regarding arrangements for the smooth working of the costing provisions of the Act. Owners of selected stations have a direct interest in the economical operation of their stations, as they repurchase from the Board all the energy required for their local distribution and have the option of paying either the cost of production, adjusted according to load factor and power factor, with a proportion of the Board's expenses, or else at the "grid tariff." Additional supplies will be paid for at the grid tariff. The total cost to the owners will not (under the Act) be more than that at which they could have generated under independent operation with adequate standby.

Sales to Distributors

The grid tariff for Mid-East England was dealt with in some detail in our issue of November 25th last. The period for which the tariff is calculated for paying expenses is, as in the Central Scotland Area, ten years. A progressive four-stage reduction of the kilowatt charge is made from £3 10s. to £2 15s., as the maximum demand increases beyond the figure for 1932. The grading has been designed to encourage development, the increments varying inversely with the basic demand with a view to providing some equality of opportunity between undertakings in advanced and earlier states of development.

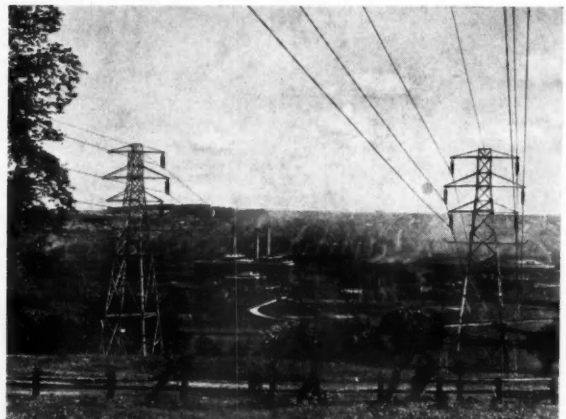
The grid tariffs have been or are being worked out with the



A general view of the Northfleet (Kent) sub-station

help and guidance of the National Consultative Committee which, with District Consultative Committees, was set up last year to ensure the closest co-operation between the Board and the supply undertakings. Mr. C. D. Taite (Lancs. E. P. Co.) is chairman and Mr. C. G. Morley New (Cardiff Corporation) vice-chairman of the National Committee. The chairmen of the District Committees are: Central Scotland: Mr. E. Seddon (Edinburgh Corporation); North-East England: Mr. H. A. Couves (North-Eastern Electric Supply Co.); North-West England and N. Wales: Mr. H. C. Lamb (Manchester Corporation); Mid-East England: Mr. W. B. Woodhouse (Yorkshire E. P. Co.); Central England: Mr. J. T. H. Legge (S.W. & S. Co.); South-East and East England: Dr. S. L. Pearce (London Power Co.); South-West England and South Wales: Mr. A. Nichols Moore (Newport Corporation).

Interconnection and control of the selected stations is expected to effect economies (1) by enabling existing reserve plant to be used for normal production, the grid providing stand-by; (2) by close correlation of new plant to demand; and (3) by the use of the most efficient stations for providing the base load, the less efficient being retained for meeting peaks.



The new Dunston generating station

The Benefits of the Scheme

In 1930-31 over 45 per cent. of the total plant installed in public generating stations was in reserve; under grid operations the safe margin is regarded as 15 per cent. The saving in capital expenditure on generation is expected, during the next decade, to exceed the capital cost of the grid, which will be about £26,700,000, a figure which is only 2½ per cent. over the estimates of the Electricity Commissioners after allowing for some modifications in the original scheme. The saving in capital expenditure due to reduction in reserve capacity will be realised only gradually, and the economic value of the grid will grow with the increase in demand. The framing of a ten-year tariff period will, however, enable its benefits to be available from the beginning of trading; this is assisted by the provision of the 1926 Act for the payment of interest out of capital and the suspension of the sinking fund.

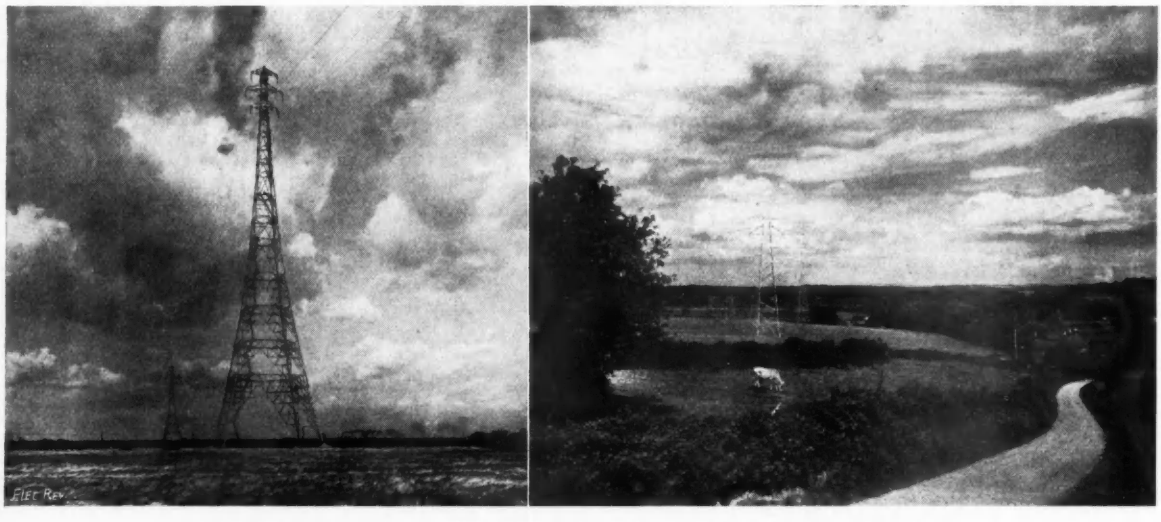
An important economic benefit to undertakings, in addition to freeing their engineers from what is now a considerable source of worry, is the prospect of paying the Board only for electricity actually required by their consumers in any year. They will thus avoid the charges on expenditure incurred in the installation of generating plant in advance of the load that will make it remunerative. We should also expect savings to be possible in many cases in expenditure on the undertakings' own distribution systems, due to the availability of grid supplies at points other than the generating stations.

The Board has power to require undertakings to standardise their frequency at 50 cycles per second, if this is necessary for the working of the grid schemes. This entails the changing not only of non-standard generating plant but also of apparatus on consumers' premises that is affected. The Board advances to the undertakings (free of interest) the expenses incurred in these change-overs. The money is borrowed by the Board for the purpose, the capital charges being met by a levy made to the Electricity Commissioners on the authorised undertakings throughout the country, on the basis of the revenue received from the sale of electricity other than that sold in bulk, or from the Minister of Labour for relief of unemployment, as on the North-East Coast.

In Central Scotland and N.W. England the programme had been completed by the end of last year, when the Board had approved in detail more than half the expenditure to be incurred. At that time the expenditure actually incurred was a little over £9 million. Frequency change-overs are also nearing completion in Central England, N.E. England, and S.W. England and S. Wales.

The cost of frequency standardisation will to some extent be recovered owing to the opportunities it offers for improvements in the layout of factory plants which enable a more extensive and more efficient use to be made of electricity.

The Board has no control over local distribution. This is still in the hands of the authorised undertakings, who will deal directly with the consumers in their areas. Presumably the consumers will receive the benefit of any reductions in costs of production which the supply authority may gain as a result of grid operation, but the very important stimulus to electrical development that can be provided by suitable tariffs, the hiring of apparatus, assisted wiring, and maintenance service will depend upon the ability of the local undertaking to deal with a progressive business.



The Thames crossing and (right) lines from Nursling to Salisbury and Winchester

The District Engineers

The executive officers of the Board are Sir Archibald Paget (general manager), Messrs. Johnstone Wright (chief engineer), Harold Hobson (commercial manager), D. W. Coates (chief accountant) and R. H. Fox (secretary and solicitor). The eight districts are managed by Messrs. A. E. McColl (Scotland), D. M. Buist (N.E. England), R. Blackmore (N.W. England and N. Wales), S. E. Fedden (Mid-East England), S. T. Allen (Central England), P. G. Campling (E. England), S. J. Watson (S.E. England), and J. W. Beauchamp (S.W. England and S. Wales).

Erecting Overhead Lines. By J. L. Eve

Methods favouring economy and speed

ORGANISATION is the chief factor in the erection of overhead lines, as the contract is spread over many miles of route, and is necessarily more difficult to supervise than the erection of a building where the whole work is concentrated on one site. The first thing the contractor does is to select a site for his local office, preferably somewhere near the centre of the proposed line, with a suitable yard and store for plant and materials conveniently near at hand.

[*Int. Rotogravure*

Mr. J. L. Eve is director of the J. L. Eve Construction Co., Ltd.

After settling the engineering details the complete route is carefully surveyed and profiled, the tower positions and heights being fixed from the profile drawing. This part of the work must be accurately carried out in order to ensure that the requirements of the Electricity Commissioners regarding clearances, etc., are fulfilled. When the profile drawing has been prepared, each tower is given a number, and a complete constructional schedule is prepared, showing span lengths, section lengths, tower heights, and complete equipment for each structure. From this information it is possible to obtain the quantities of every type of material that will be required, also delivery sites.

The materials are then ordered, and delivery arrangements made in order that continuity of work may be achieved, but at the same time the contractor endeavours not to tie up too much capital in material which will not be required for some time ahead. The arrangements regarding time and place for the delivery of material are of great importance, both from the point of view of economy and time. For instance, in delivering steel-tower sections, particular care should be taken that the sections are bundled and properly marked, because the delivery of one section or one bag of bolts to a wrong tower position causes considerable delay and expense.

A Multiplicity of Parts

On a typical 66-kV grid steel-tower line, a normal intermediate tower consists of roughly 2½ tons of steelwork, made up of approximately 300 members, and 700 bolts. In addition to this, at each tower position there are required ballast and cement for foundations, sets of insulators, fittings, and many small parts. When it is realised that material for each tower position has to be delivered to anything up to eighty positions in one week on the same contract, it can be readily seen how important is the efficiency of the delivery arrangements. It is usually found advantageous to have deliveries made by the manufacturers to the nearest hard road site, and for the contractor to handle the distribution of the material to tower positions by means of six-wheel lorries, fitted with caterpillars, and/or caterpillar tractors, according to the nature of the country.

Great care must always be taken to see that conductor drums are delivered near the site of the section tower from which the drum is to be run out. The delivery of insulators also needs great care. Experience has shown that insulators should be packed in wooden frame crates (one complete set of insulators per crate), and that the correct number of sets should be placed near the site of each tower. A reasonable number of spares should be within easy access during the time of erection, as it is always bad practice to borrow material from another tower position when a shortage is discovered at the tower position where work is being carried out.

Excavation and Levelling

The excavation for the tower foundations needs careful supervision if speed and accuracy are to be achieved. The sizes of the holes should be carefully pegged out, and the depth information clearly indicated and checked. As excavation is generally proceeding at several positions at the same time, it is necessary for the engineers on site to be ready in advance for the shifting of the various gangs to new sites as soon as the work is completed. Time and money are lost if men are allowed to wait about for instructions. When concreting the tower foundations, economy can only be maintained by strict supervision of the delivery of ballast, cement and water, because a shortage of any of these would cause considerable delay.

It is necessary to take great care in setting the tower foundation stubs. A very small error in the levels or plan measurements will either throw the tower out of the vertical, or make erection extremely difficult and perhaps impracticable.

The erection of towers is always considered one of the most important field operations. One method is to assemble the tower in a horizontal position on the ground, and then pull it up by some motive power, or by the use of derrick poles, but the most favoured method, especially in this country, is to build the tower up section by section. For accurate and rapid erection, it is essential that clearly marked erection drawings should be supplied, that the scantlings or sections should be clearly numbered and laid out in a systematic manner; an erection gang should consist of as few men as possible—four or five men being the usual number. All bolts should be well tightened, but not overstrained.

Left: Lowering the foundation stub steelwork into position. Right: Setting and levelling foundation stubs with a steel template

Before running out the conductor, it is necessary to erect running-out blocks for at least one section, *i.e.*, from one anchor or terminal position to another. Some engineers prefer to erect the insulators first and then attach the blocks to them. Others support the block for the

Left: Erecting a tower with a power winch mounted on a lorry. Right: Constructing the tower section by section

cross-runs by wire rope slings, and erect the insulators after the conductors are run out. The actual method of running out the conductor is governed, to a great extent, by the type of country over which it is to be run. On open plains, where no obstacles exist, the practice generally adopted is to mount the drums on drum wagons, and pay out the conductor as it is hauled along the route. Conditions rarely exist in this country that allow this method to be adopted, owing to ditches, hedges, roads and railway crossings; consequently, the drums are mounted on drum stands behind the anchor towers, the end of the conductor is passed through the pulley block, and then hauled along the line just past the next tower position; the end is passed through the block as before, and so on, until the anchor tower at the other end of this line section is reached.

The conductor has then to be strained up to give the correct sag, and made off in to the clamps attached to the insulators at both ends of the section. This is generally done by the use of either blocks and ropes, or winches; most contractors have lorries equipped with winches for this purpose.

The final work of erection of a line consists of fitting number plates and anti-climbing devices on each tower, and clearing up any surplus material or earth. During the process of erection, care should be taken to fence up any gaps that have been made in hedges. During the transfer of material or men across fields, one track only should be used, in order to minimise damage to crops.

Overhead Line Problems. By H. S. Ellis, M.I.E.E.

Methods of obviating some troubles on 33-kV systems

I AM satisfied that "bird trouble" need not exist to anything like the same extent that it has done in the past, provided reasonable care is taken in design. Nothing will prevent birds taking full advantage of the perches provided by overhead lines, but the supports can be so designed as to make it practically impossible for a large bird to make contact between them and the conductors. Lines with suspension insulators are practically immune from this trouble as the distances between the conductors and the cross-arms are considerable, and a bird will nearly always fly to the cross-arm because of its prominence and the better grip to be had there. If pin insulators are used in conjunction with the ordinary flat cross-arm, the bird will land on the cross-arm with one of its wings across the conductor, with the inevitable result.

Mr. H. S. Ellis is with the West Gloucestershire Power Co., Ltd.

The top phase of a pin insulator line should be immune provided the insulator pin is fixed at the centre of the top of the standard so that the bottom shed of the insulator almost entirely covers the top of the standard. The other two phases should be supported on pins sufficiently long to make contact (by the bird) between the line and the cross-arm impossible, or, better still, the cross-arm should be turned upwards at each end or inclined to ensure that a bird cannot perch close to the insulators.

Bird guards will go a long way towards preventing this sort of trouble, but one would not nowadays design supports requiring this expedient, and it should be unnecessary except on lines the reconstruction of which would be difficult and expensive. Great care must be taken to protect such places as section towers and sub-stations where apparatus such as switches, fuses and cradle guards are employed.

The Importance of Insulators

Insulators are the principal component of an overhead line, and although these appear nowadays to be as perfect as one could reasonably expect, they are still a potential source of trouble if improperly assembled. Large insulators have to be built up by cementing one insulator to another, and if the cement is of the wrong sort, or if there is too much of it, trouble will ensue of a kind that is usually much more serious than that due to birds. It may result in a permanent fault, whereas the bird generally causes only a temporary fault which is cleared as soon as the first trip of the switch occurs, by which time the bird has "gone west."

The route for the line must be selected with a view to obviating failures due to the presence of trees or to malicious damage. It is surprising how many avoidable faults occur due to sheer carelessness during construction, *e.g.*, use of clamps of incorrect size, faulty wiring of current transformers, and a dozen other things. I have in mind one case in which a line operated perfectly for a number of years until the load on it grew sufficiently to reveal that the current transformers connected with the overload relays at one end had been incorrectly wired, converting what was supposed to be plain overload protection into the equivalent of earth-leakage protection, *i.e.*, the switch operated at loads very considerably below the relay setting. In another case much inconvenience was caused by a bad contact on an air-break switch due to the use of a length of lap-welded tube instead of a solid-drawn tube for connecting the switch at the top of the tower to the operating handle at the bottom. In time, and due to strain, the welding gave way and the tube twisted sufficiently to allow the contacts to come apart, the result being that arcing occurred between the switch contacts to such an extent that the line had to be made dead quickly. Where lengths of cables are connected to overhead lines only the best type of sealing box filled with the right kind of compound must be used, so as to ensure that no cavities are formed inside the box where moisture could lie. Pole boxes are subject to very varying conditions of temperature which cause much trouble if these points are not guarded against.

Possibilities of Electrolysis

Electrolysis might not be expected on overhead lines. But it will be experienced if due care is not taken when selecting connectors for use between conductors of dissimilar metals, such as aluminium and copper, and in fixing them.

An interruption which occurred recently on an overhead line was found to be caused by an omission to fill the space inside the connector with grease, so that water had got into the connector and electrolysis had occurred. In this case the whole of the copper conductor within the connector had been corroded away with the result that the copper tail, which was under slight strain, was ultimately pulled away from the connector and the supply interrupted on the phase wire affected. There is no doubt that if the connector had been properly filled with grease so as to exclude moisture this interruption would not have occurred. This incident shows how easy it is, in spite of all the care that may be taken in selecting one's materials, to be let down by those whose business it is to carry out the work in a proper manner. Other similar connectors which have been carefully inspected, and which were found to have been properly filled up with grease, showed little or no signs of internal corrosion.

These are just a few of the numerous kinds of faults that are definitely traceable to either faulty materials or bad workmanship. Many of them are familiar enough to those of us who have had long experience of the operation and maintenance of overhead lines, and they are mentioned in the hope that they will serve as a warning, or, perhaps, a guide, to those who are just now about to extend from the urban into the more rural parts of their areas of supply.

This method of mounting insulators is bad for birds and the line as well

Lightning will continue to menace us, and so will salt in those areas which are close to the sea; and so will hail, snow, rain, and wind, not to mention those irresponsible people who have stones near at hand. But, in spite of all this, I am satisfied that overhead lines can be built in such a way as will ensure service almost as good, if not quite as good, as—well, perhaps I had better say—any other means of transmitting electricity from the source of supply to the consumer.

Voltage Drop in Rural Areas

The case for single-phase distribution

By W. A. TURNBULL, M.I.E.E.

THE purely rural electricity supply load in small towns, villages, and farms is so small compared with the demand in larger towns that any trouble from voltage drop on 11-kV lines does not arise, at least for an area of, say, twelve miles surrounding the supply point, even when these lines are composed of 7/12 s.w.g. galvanised steel wire. This is more than made up for by the drop on the l.v. lines, due to (1) the distribution being overhead the spacing of the conductors materially increases the impedance as compared with underground cable; (2) the considerable distance between adjacent residences; and (3) the tendency of villages to extend in the direction of the country road, again increasing the length of the distributor.

Notwithstanding these difficulties and the proportionately less revenue, the Commissioners' allowance of 4 per cent. should be adhered to because (1) it is asked for, (2) easy transport and other considerations are bringing more consumers into the country, and (3) as the price per kWh falls, as a result of propaganda, more electricity will be used. The special temporary allowance of 8 per cent. drop allowed by the Commissioners should not be taken for granted.

The bulk of the distribution in rural areas is three-phase, with four 0.1-sq. in. conductors giving a total area of 0.4 sq. in. In the Aylesbury district I am using single-phase, three-wire distribution (two 0.1-sq. in. outers and 0.05 neutral, total area 0.25 sq. in.) with entire satisfaction. Weight for weight of conductor, three-phase distributors should transmit more power for the same drop than single-phase three-wire, but if the neutral is halved in the case of single-phase, then copper for copper single-phase will give about 5 per cent. less drop than the three-phase.

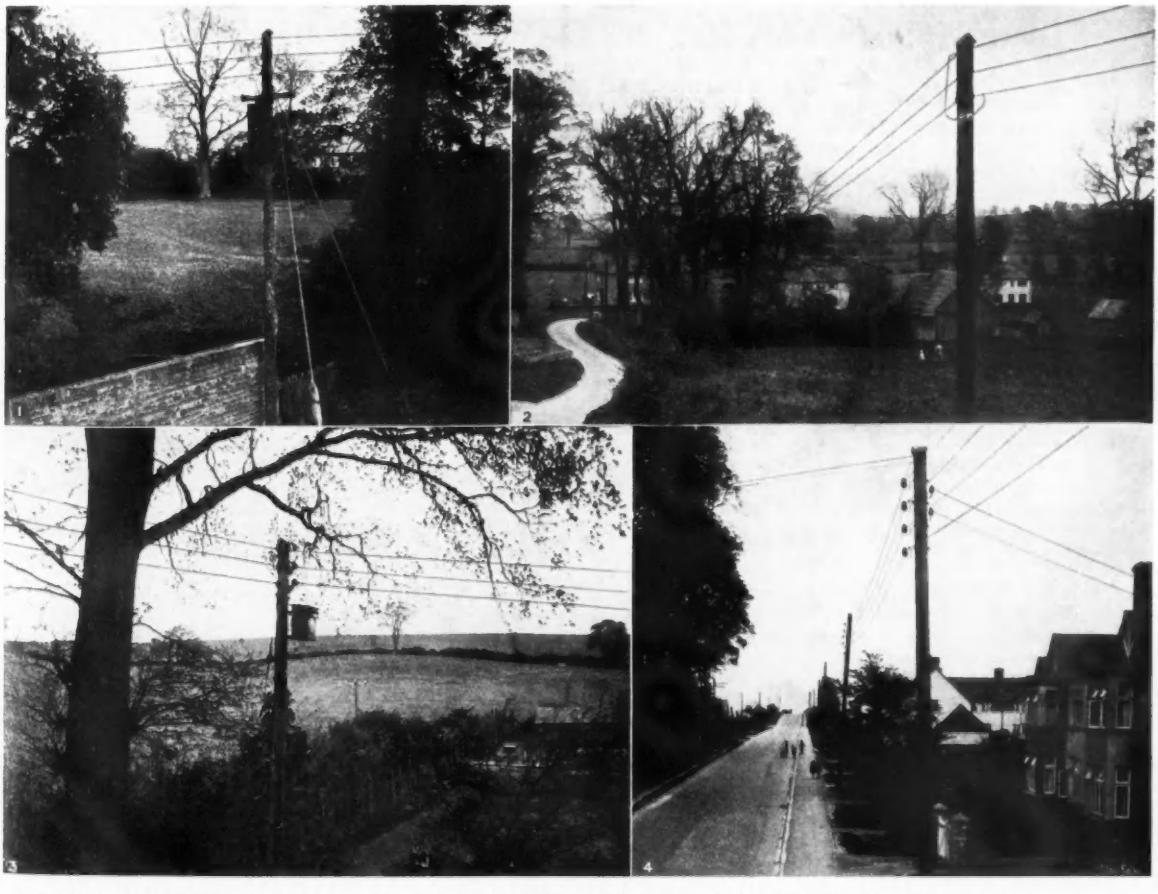
I maintain that the neutral current with single-phase is much less than with three-phase due to the better balancing of consumers by their division into two groups instead of three, this permitting a smaller neutral for single-phase. Most of the villages will yield fewer than fifty consumers, ranging from the lord of the manor down to the farm labourer, the extremes being similar to those in a large town, and it is difficult to balance them. Fortunately, the small static balancer comes to our aid; this costs less than £10, occupies a space of about 18-in. cube, and is easily attached to a pole, and the loss is about 50 W. Occasionally a large consumer (revenue £50 a year) perhaps half a mile from the village comes on to the supply; here the 0.1-sq. in. outers and a galvanised steel-wire neutral acting as a guard wire may be used with a static balancer on the consumer's premises.

Mr. W. A. Turnbull, M.I.E.E., M.Inst.C.E., Wh.Ex., is borough electrical engineer of Aylesbury and has had considerable experience of rural electrification

Tail-end Boosters

As the load develops, additional steps to deal with voltage drop have to be taken, and I have recently installed a Ferranti tail-end booster. This is placed at a point about two-thirds of its length along the distributor from the transformer and is current-controlled, a current solenoid operating an adjustable mercury switch energising the primary at 230 V and giving a 3 per cent. boost; when the current reaches a further stage a second mercury switch puts 460 V on to the primary, giving a further 3 per cent. boost. It is necessary to have a balancer on the line near the booster, as the automatic gear is operated by the load on one of the line wires only. The cost of this booster is £28; it is about three feet high and one foot square, and is pole mounted. There is a big field for the use of these boosters, and it is to be hoped that they will prove reliable and free from repairs and that they can be made voltage-controlled instead of current-controlled without increasing the cost.

Tail-end boosters provide an economical means of bridging the period from the commencement of the volt drop trouble



1. A single-phase Ferranti tail-end booster. 2. A single-phase distributor. 3. A single phase static balancer. 4. An example of three-phase distribution

until the load has developed sufficiently to warrant the installation of a further sub-station, which is a fairly simple matter. The second sub-station would probably be half a mile from the first; the cost would not exceed £90 for the single-phase steel-wire line plus £40 for a 25-kVA transformer complete with switch and protective gear. The half mile or so of h.v. two-wire line between the transformers would pass along the back of the village and be less conspicuous than a three-phase line. The transformer should be brought right up to the village to avoid the cost and drop on a l.v. line. In Northwich Mr. Fennell is using a compound line with one phase of the secondary three-phase h.v. system earthed. One of the two-line h.v. wires is run on the top of the distribution pole; below this are the two l.v. wires and also the earth wire for complying with the regulations for earthing h.v. pole wherever the volts are low. By using the earth wire as the return of the h.v. system a saving of one wire is effected.

An elaborate scheme of electrical illuminations was carried out at St. Peter's, Rome, upon the occasion of the Whitsun ceremonies

Cheapness is Essential

This treatment may be considered parsimonious, but the revenue from rural areas is less than from towns for a proportionate outlay. The costs of repairs and maintenance are also heavier, so that any legitimate economies must be accepted so long as the volts are not affected. The employment of steel wire gives cheap h.v. lines capable of carrying many times the power required, and (away from salt or fumes) with a life of at least twenty years. Power in the villages is conspicuous by its absence, so that the cheaper and less prominent single-phase distribution answers all purposes; even with three-phase available, single-phase would be used for small motors.

Advocating every possible economy implies not that there is little profit but that the proportion of profit to capital and revenue is less for rural than for town supply. For example, at Aylesbury a profit of £5,301 was made in 1932; equitable division of the costs gave £795 rural and £4,506 town profit. Had the profit been proportional to revenue and capital it should have been £3,450 rural and £1,851 town. Allocating only the additional costs involved in giving the rural supply there was an estimated profit of £10,413 to the credit of the rural supply.

Four-wire Circuits. By G. W. Stubbings, B.Sc., A.M.I.E.E.

Various methods of metering energy

OF the several methods in regular use for the measurement of electrical energy in three-phase four-wire circuits the simplest is that which treats the four-wire circuit as three single-phase circuits with a common lead, and employs three single-phase meters. In place of the three meters, a polyphase instrument with three wattmeter elements can be used; in such a meter each of the three elements can communicate its torque to a separate disc, or two elements can be used in conjunction with one disc, so that the whole meter can be accommodated in a case of standard size.

A third method in very common use depends upon the fact that the differences of two pairs of line currents, associated with properly selected phase-to-neutral voltages, give a value of the total power in the circuit which is accurate, provided that the vectors of the three phase-to-neutral voltages form a closed triangle. The last method when used for heavy current circuits enables a standard three-phase meter to be employed, the differences of the pairs of line currents being obtained by the delta connection of three current transformers, and, on this account, it is probably the most popular method, in spite of its theoretical limitation.

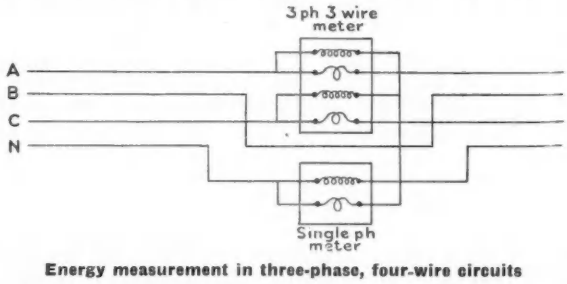
Wattmeter Connections

According to a well-known theorem, the number of wattmeters required correctly to measure the power in a polyphase circuit is one less than the number of wires; the current coil of a wattmeter is connected in every line but one, and the voltage coil of each instrument between the line in which its current coil is connected and the line which contains no wattmeter. The line to which the voltage circuits of all the wattmeters is connected is thus treated as the common return for the others. In the usual method of power measurement in four-wire circuits, the neutral wire is invariably treated as the common return and the wattmeter elements carry the line currents. The neutral of the circuit is not necessarily chosen to represent the common return; any one of the other three lines may be so used.

The arrangement illustrated shows a standard three-phase three-wire meter connected in the usual way with both its voltage coils joined to B phase, and a single-phase meter carrying the neutral current with its voltage coil connected between B phase and neutral. This combination will correctly measure the energy in the circuit without any restriction regarding a zero value of the residual voltage. An independent proof of this statement can be exhibited very briefly, the quantities in the equations being regarded as vectors.

The total power indicated in the circuit is $I_a(V_a-V_b)+I_c(V_c-V_b)$ by the three-phase meter and I_nV_b by the single-phase meter in the neutral lead, the symbols representing line currents and phase voltages. The total indication is therefore $I_aV_a+I_cV_c-V_b(I_a+I_c)+I_nV_b$, but as $I_n=I_a+I_b+I_c$, and $I_b=I_n-(I_a+I_c)$, the total indication thus corresponds to $I_aV_a+I_bV_b+I_cV_c$, which is the same as that given by three single-phase wattmeters connected in the usual way.

The practical advantage of this method is that, as in large three-phase four-wire installations the neutral current is relatively very small, the combination of a standard three-phase and single-phase meters will often be cheaper than a two-element meter using three current transformers delta-connected. Its disadvantages are that the whole consumption is not indicated on a single register, and that the registration of the neutral meter may be in either direction according to the loading. If this meter indicates a negative consumption, this consumption must be deducted from the registration of the three-phase meter.



Energy measurement in three-phase, four-wire circuits

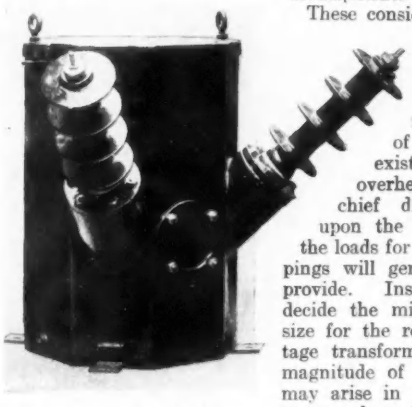
A zero registration of the neutral meter does not necessarily indicate a balanced load, as the neutral current may be in phase quadrature with the B phase to neutral voltage. For heavy-current circuits the method gives a very economical method of energy measurement, which is accurate in all conditions of voltage or current unbalance, requires but two current transformers, and is free from the defects of meters in which three wattmeter elements are combined in a single instrument.

Tapping High-voltage Lines. By V. Z. de Ferranti

New developments that will assist rural electrification

TO everyone seriously interested in the development of public electricity supply in Great Britain, it is a question of vital concern how best to make the many advantages of our national electricity scheme generally available to the farmer and to small rural communities. With the construction of the "grid" nearing completion, the rural dweller begins to feel impatience at the non-fulfilment of his own electrical expectations.

We look forward to a time when the whole country will be covered with a complete distribution network bringing electricity to every home and, in this direction, a good start has been established by the several rural distribution schemes which are already in operation. But meanwhile, in many parts of the country traversed by main and secondary transmission lines, there are large areas in which no provision has yet been made for electrical development. For these areas, it is imperative, both on the grounds of our obligation to the public, and our urgent need of additional load for the "grid" that we should consider every possible means of hastening development.



An "economic" transformer for rural supplies (5 kVA, 33,000 V)

These considerations will be directed principally towards the finding of the most economical methods of tapping the existing high-voltage overhead lines. The chief difficulties centre upon the small nature of the loads for which these tappings will generally have to provide. Insulation problems decide the minimum limit of size for the required high-voltage transformers, whilst the magnitude of the surges that may arise in the transmission system has to be reckoned with, both in connection with the transformer itself and whatever may be installed in the way of switchgear between the transformer and the high-voltage line.

Progress in Design

In this connection it is encouraging to note what big strides have recently been made in the design of small high-voltage transformers and in the development of high-voltage fuses. The transformers shown in the accompanying illustrations indicate the small sizes of single-phase units suitable for pole mounting that can now be produced at an economic price.

Both of these transformers are designed for fully insulated systems, but for higher voltage working, advantage would be taken of the fact that the neutral point is solidly earthed. The high-voltage insulation may thus be graded between line and neutral and the transformer provided with only one high-voltage terminal. The 50-kVA single-phase transformer shown in outline drawing has a ratio of $132000/\sqrt{3}$ to 230 V for connection between line and neutral, and would appear to represent the economic minimum of to-day for 132-kV operation. This transformer in a plain steel tank with one 132-kV terminal, has its insulation and its terminal bushing of the same standard as in the large grid transformers. The winding is designed for special surge-proof construction. The total weight, including oil, is about four tons.

A general comparison between the three transformers mentioned is afforded by the following table of characteristics:—

Working voltage.	Capacity single-phase.	Insulated.	Height overall.	Weight with oil.	Price.
33 kV	5 kVA	Fully	3ft. 1in.	5 cwt.	£55
66 kV	10 kVA	Fully	6ft. 9in.	1 ton 18½ cwt.	£330
132 kV	50 kVA	Graded	13ft. 0in.	4 tons	£450

So dependable is the modern transformer that risks due to its possible failure are almost negligible. Nevertheless the importance of maintaining continuity of operation in our main and secondary transmission lines is such that in tapping them it will be deemed essential for some form of interrupter to be interposed between the transformer and the line. For these small load outlets the cost of high-voltage oil circuit-breakers is prohibitive; for the solution of this difficulty we look to the high-voltage fuse upon which so much excellent development work is being done.

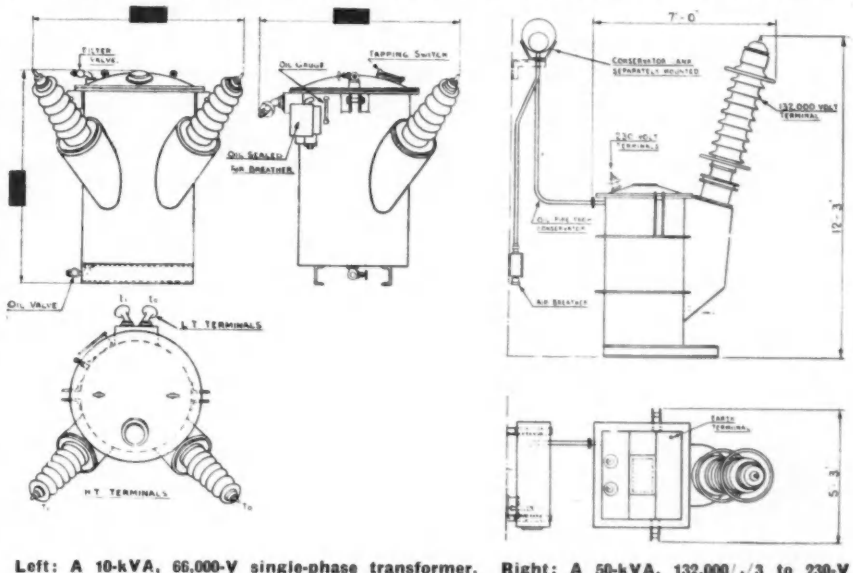
Mr. V. Z. de Ferranti is chairman of Ferranti, Ltd.

It is now possible to obtain 132-kV fuses with short-circuit rupturing capacities approaching one million kVA. Fuses of the carbon tetrachloride type have been for several months in successful operation on the grid and reference is made in the latest report of the Central Electricity Board to another type of fuse now under test, the outstanding feature of which is the extremely low cost of fuse replacement. These fuses, in conjunction with the simplest possible isolating switch seem to point the way to the early provision of economic rural supplies from the existing high-voltage lines.

Moderate Cost

It may be regarded generally as a commercial proposition to tap 11-kV lines for giving a supply to any isolated farm of quite moderate size. For a small three-phase supply, the following figures may be taken as an indication of the main items of cost: 10-kVA transformer, 11-kV, 3-ph., 50 cycles, £35; h.v. switch fuse (oil break) £27 (or air break £20). The second item may generally be saved, since on branch lines and even on most of the tertiary transmission lines of this voltage, it is likely to become the usual practice to treat the transformer as part of the line and install it without any switch or fuse on the high-voltage side.

Any consideration of rural development raises again the question of three-phase *versus* single-phase distribution. The points of argument on both sides are so familiar that they need not be repeated, but it is well to remember that on the farm, as in the ordinary household, by far the greater part of the requirements represent essentially a single-phase demand; lighting, heating, cooking and water heating will account probably for ninety per cent. of both the load demand and the energy consumption on the average mixed farm. The power requirements are, in fact, of quite secondary importance, and, for the sake of the benefits that he gains from the



Left: A 10-kVA, 66,000-V single-phase transformer. Right: A 50-kVA, 132,000/√3 to 230-V transformer

other electric services, the farmer will usually be willing, when necessary, to face the higher cost of single-phase motors. For the sizes that interest the farmer, the single-phase repulsion-start induction motor is a practical proposition. Generally, therefore, when the provision of a three-phase supply is doubtful of economic justification, it is recommended that the alternative of single-phase should be adopted.

There are restrictions at present against earthing a system at more than one point, but there would appear to be no adequate technical reason why they should not be relaxed in so far as may be necessary to permit of giving these small supplies by means of single-phase transformers connected between the high-voltage line and earth.

One last important point which should be mentioned in connection with rural development relates to the question of voltage regulation. It is now commercially possible to install regulating equipment on the transformer at every hamlet and so the pressure of the high-voltage transmission need not be kept within close limits.

It is very desirable to provide for the installation of regulating apparatus at the point where the transmission line is tapped and at such points as may be necessary along the distribution lines. The first can well be provided in the form of automatic tap-changing on the step-down transformer, whilst the second is most suitably achieved by independent voltage regulators.

Meter Maintenance. By E. Fawssett, M.I.E.E.

Some considerations affecting the methods adopted

I BELIEVE that most people would agree that the best of the modern small single-phase meters are now so good that there is little likelihood of their becoming obsolete. In the past obsolescence, *i.e.*, inferiority to the best practice and performance of the day, has played a considerable part in determining the life of a meter, and hence whether it is not better to scrap it and buy a new one than spend any money at all on it. For instance, a 230-V, 20-A meter in a semi-electric house would to-day have a reasonable accuracy on an all-mains wireless set alone, or on a cooker and radiators totalling over 30 A; but meters of ten years ago, while in perfect condition mechanically, would be apt to be unreliable on the wireless set, either creeping at all times, or under-registering the consumption; they would certainly be slow on the upper load indicated.

Thus, if a new meter costs, say, just over £1, and the old one would cost 5s. to overhaul and re-test, it is easy to see that the loss of revenue by merely reconditioning the old one could well exceed the replacement cost in a very short time. Personally, I have an intense dislike of scrapping serviceable apparatus, and I find that I have to keep the above points constantly in mind to prevent myself allowing obsolescent meters to get back into service. Perhaps others feel the same reluctance, but if we can improve the supply authority's net revenue and also give the manufacturer more work there is a lot to be said for having nothing but the most modern meters on our mains.

Ten Years' Service

So the period between changes depends on the type and age, but any good modern single-phase meter should now be able to stay out ten years without appreciable deterioration if certain points were carefully attended to before it went out. These include ensuring that the cover was a perfect fit, the meter scrupulously clean, mechanical and electrical conditions up to the highest standard, and, most important of all, correct treatment, according to our present knowledge, of the lower jewel bearing.

It is essential to prevent the pivot rusting, and this can be ensured if a suitable oil is retained in the bearing all the time the meter is out. Many oils would creep away, evaporate, or gum up, but there are certain stable oils of the paraffin group (which can be rendered more stable by colouring them red to reduce the action of light) that, so far as tests have gone, would seem to be the most suitable. Without some deterrent these oils would creep out of the bearing, but this can be prevented by coating the surface of pivot and jewel with "Epilame," which forms an invisible, extremely hard, and very thin layer across which oil simply will not go. Nowadays cases of magnet weakening, enough to bring the meter outside the specified limits of accuracy, are very rare.

Polyphase meters generally measure greater quantities of energy, and are also prone to various troubles of their own, so that, even if only as an insurance against errors, they should be examined much more frequently. The large single meter is the biggest risk, and ought to be tested at least once a year; better still, no big account should be based on one meter alone, but on the mean of two, which, if they keep closely together on the monthly readings, need not be checked more often than once in two years. It is usually most convenient and economical to test these instruments on site.* Small whole-current polyphase meters are best changed and returned to the testing department every three years. The annual cost of this service for polyphase meters in general should not exceed 0.1 per cent. of the annual revenue therefrom under ordinary conditions, and it is evidently abundantly worth while.

Direct-current house meters cost very much more for maintenance than their a.c. counterpart, as they have to be removed more often, and replacement of parts is required on a much larger scale. Five years is quite sufficiently long to leave such a meter out, this period being arrived at by comparing the inevitable fall in accuracy over various terms of years with the cost of removing, repairing, and testing. Fortunately, owing to the enormous number of change-overs in progress, very few of these will be left on circuit in five years' time.

*See I.E.E. Journal, Volume 69, No. 413.

Prepayment Meter Problems

Prepayment meters are in quite a different category, and, good as some modern types are, all are a thorn in the flesh of the department responsible for them. In this case it is not the meter proper so much as the coin mechanism that requires looking after, and the need for this varies widely between districts; thus the treatment a shilling mechanism gets in a better-class London suburb is vastly better than that accorded to its penny brother in parts of the industrial North, where every artifice is tried in the way of rough handling to obtain something for nothing.

[*Elliott & Fry*

Mr. E. Fawssett is testing engineer to the North-Eastern Electric Supply Co.

The nature of the undertaking's area will settle how this type of meter can be maintained in the best and cheapest way. Mechanism faults require, as a rule, immediate attention, and, as no repairs are usually practicable in the house, the offender has to be changed. In a scattered area a number of depôts may serve as local stores giving temporary repair facilities, so that when a number of faulty meters have accumulated a skilled squad may be sent out to put them right, and, as often as not, incorporate improvements as well. The problem is linked up with the revenue obtained, the cost of the various methods, and the type of area, so that each undertaking has to consider the best method itself.

In general, the prepayment meter, however much disliked by the testing department, is a very good friend to an undertaking, as it costs much less so to collect the revenue than by a quarterly account; also it gets in the money sooner, and, moreover, makes certain of it, barring the few cases of theft. There is not much margin of profit on a small slot-meter consumer, so it is essential to get in the last penny piece due, and keep down maintenance costs, by buying a thoroughly reliable and robust type and ensuring, by skilled and conscientious work, that every meter, once through the repair department, can be forgotten about for at least ten years thereafter.

Even so, on an installation of 100,000 such meters, if this were not bettered, 10,000 would have to be handled through the change-repair-test-change routine each year. Actual experience of the maintenance of such a quantity, the majority of which are quite modern, but some 40,000 a good many years old, shows that nearly 7,000 mechanisms are dealt with annually for repair or improvement, of which some 3,000 require the meter portion to be recalibrated as well. In other words, on the average a good slot-meter runs for fifteen years without a fault. Put this way, its behaviour appears far better than one would think possible, knowing the diverse nature of the troubles that occur, and the rough treatment experienced at the hands of the consumer.

Electricity in Horticulture. By F. H. Clough, M.Inst.C.E., M.I.E.E.

Its scope and limitations

IN both agriculture and horticulture it is necessary to ensure that the plants have a suitable soil to grow in and an adequate supply of air, moisture, heat, and sunlight. In tropical climates there is usually plenty of heat and sunlight, but sometimes a deficiency of moisture, necessitating irrigation. In temperate climates, such as in England, there is frequently a deficiency of heat and sunlight. In order to make good the deficiency of heat it is necessary in many cases to grow the plants under glass, and in cold weather to supply the necessary additional warmth by some artificial means.

Electricity can be converted readily into mechanical power, heat, and light, and also into many forms of high-frequency radiation, which influence the growth of plants. It is therefore potentially of great assistance to horticulture, but its use is limited at present to those cases where it can bring about a reduction in cost or give added convenience. In the future it may be possible to achieve results electrically which are not at present attainable.

Mr. F. H. Clough is assistant chief engineer at the Rugby works of the British Thomson-Houston Co., Ltd.

For irrigation electricity has already been very extensively used in enabling power to be brought over long distances to operate pumps which are often automatically controlled. In the alluvial plains of India water can frequently be found at a reasonable depth in wells, and the electrically driven pump is fast replacing the Persian wheel operated by bullocks.

From the point of view of convenience electric heat in the glasshouse is ideal. It can be supplied readily at any desired temperature, both for heating the air and also by means of buried cables for heating the soil. Many small glasshouses employ electric heat, especially those for growing salad crops and for raising seedlings. By placing buried cables under the soil and generating a small additional heat it has been found that early and better crops can be raised. As the amount of heat required for this purpose is not very great this form of soil heating is beginning to find considerable application.

For large greenhouses the heat can be more cheaply produced by the combustion of fuel. Electricity, however, can play an important auxiliary rôle; a small electric motor can be made to operate a fan for forcing the air through the furnaces, and at the same time to drive a pump for circulating the hot water through the pipes, thus ensuring a uniform distribution of heat. This arrangement allows a better control of the furnaces, and also enables cheaper fuels to be burnt satisfactorily, resulting in a considerable saving in the total cost of heating the greenhouses. During varying weather conditions the furnaces can be rapidly brought up to full heat during cold spells, and equally rapidly closed down during warm spells, thus effecting a further economy in fuel.

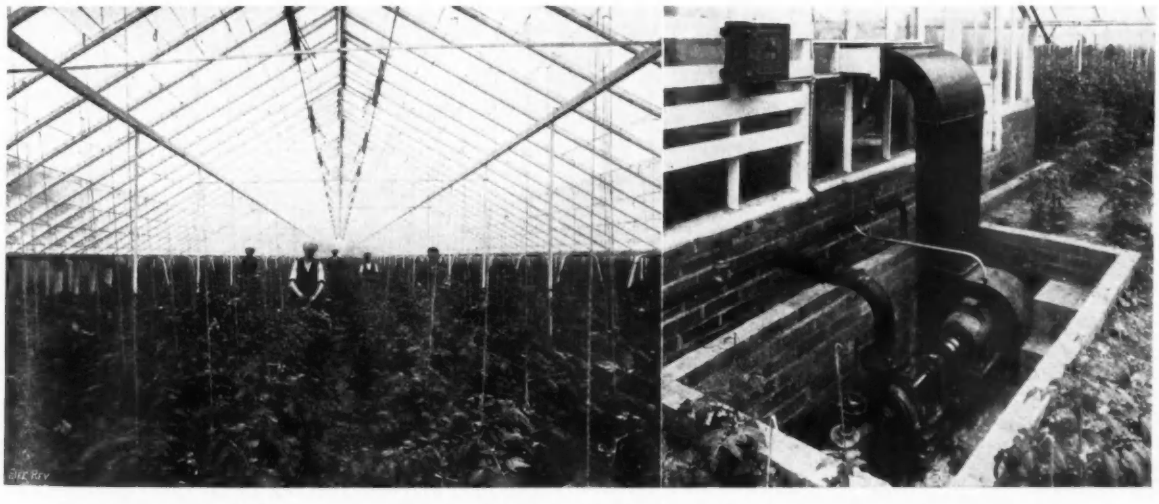
The Keith Blackman-B.T.-H. equipment illustrated controls the heating for one acre of glasshouse. With the increased activity in nursery gardening and greenhouse cultivation resulting from the recent change in the fiscal policy of the country these small electrical adjuncts to the greenhouse are likely to find a very extensive use in the near future.

As plants assimilate hydrogen from the air, and still more nitrogen from the soil, from time to time nitrogenous fertilisers are needed. In the preparation of these fertilisers electricity plays an enormously important part, but the electrical fixation of nitrogen lies outside the scope of this article. Plants also assimilate carbon-dioxide from the air and release oxygen, and in so doing continuously replenish the world supply of oxygen. Experiments have been made on the effects of varying the constitution of the air in which plants are growing, but so far no appreciable beneficial results on their growth have been obtained.

Artificial light can certainly supply the deficiency of sunlight during the winter months, but, although by this means flowers and vegetables may be brought to market earlier than otherwise possible, the increased price obtained for the produce has not shown much gain over the additional cost of the light. This state of affairs, however, is not likely to persist, and the future may see a considerable extension of the use of electric light for this purpose. An interesting case in which plants have been grown by artificial light occurs in one of the well-known caves in this country, where, a quarter of a mile underground, ferns have started to grow after the introduction of gasfilled lamps for lighting the cave.

Electric heat may be used for sterilising the soil. Here again convenience rather than cheapness determines its use. For small-scale working the soil can be put into boxes through which an electric current can be passed which heats the soil to about boiling point. For large houses sterilisation *in situ* by steam is cheaper. In cultivation electricity has not yet been used to any great extent, but in some orchards and vineyards a small cultivator hauled by means of an electrically driven winch has proved very convenient and cheap; it is possible that this arrangement may find an extended use, although the more mobile petrol tractor is a serious competitor.

While electricity does not play a predominant part in horticulture, except perhaps in the manufacture of fertilisers, it is an exceedingly convenient adjunct, and there is no doubt that it will find increasing use.



A large electrically heated tomato house and (right) a typical fan and circulating pump driving equipment

Smoke Abatement

Twenty-seven local authorities meeting at Newcastle-on-Tyne on May 27th, at the suggestion of the National Smoke Abatement Society, decided to form a joint regional advisory committee to secure greater uniformity in the administration of the law relating to the emission of smoke, to standardise methods of taking observations, to organise training courses for stokers and boiler attendants, and to bring about a better understanding between local authorities and manufacturers. Similar committees have been formed and are already working successfully in the Midlands, the West Riding of Yorkshire, and Manchester.

Rural Electrification. By W. H. Jones, B.Sc.

Some economic considerations

THE farming industry is at present largely undergoing reorganisation; methods of distribution of farm products are being carefully examined with a view to improvement but before much amelioration can be achieved production processes must also be reviewed. Innovations in agriculture have been numerous in recent years, yet there is the enigma that in spite of the great advances made, farmers as a body have not improved their financial position to a commensurate extent. Unless changes prove of benefit to the people who incur the expense of introducing them they run some risk of falling into disrepute, and consequently of not being utilised to their fullest extent.

In some essential respects electricity has come to the aid of farmers, but before its introduction can give satisfaction it needs an understanding on their part which extends beyond the mere pressing of a button. Farmers cannot be expected in the first instance to be familiar with the peculiar characteristics of electric current as a source of light, heat, and power. They must be brought to realise that the supply undertakings have invested considerable sums of money in the erection of lines with the expectation that their outlay will prove remunerative.

A 2-h.p. motor, with adjustable pulley, driving a cream separator

The cost of generating electricity does not form a high proportion of its total cost to the farmer; distribution charges are more important, and these tend to decrease, per kWh sold, as the loading of the lines approaches their capacity. The farm load therefore is an important economic factor, and while daily and seasonal fluctuations will remain, the larger the number of uses to which electricity is put the more even the demand tends to become. These phases of the problem should be repeatedly brought to the notice of farmers to assist them to realise what are the factors which influence the price they pay for electricity.

What the Farmer will Appreciate

There are two distinct aspects of the appeal of electricity to the country folk. In the first place it is a source of power which in many ways admirably meets their requirements. But farmers will not immediately scrap their present plant; they will in general do it cautiously and judiciously, and any advice given them with regard to the economy of electricity must take cognisance of the system of management pertaining to each holding. Owing to the simplicity of its manipulation and its reliability, electricity can be used in such a way that much labour time is released on farms. But the economical utilisation of labour is one of the chief factors in the lowering of farming costs.

The displaced labour becomes available for other work which cannot be performed by mechanical means. The highly adaptable portable motor has proved invaluable. Features which appeal to farmers are that as no inflammable fuels are required the risks of fire are considerably less, and the motor cannot be damaged by frost.

In an inquiry recently conducted in South Wales information was obtained relating to the cost of motors and their installation. For motors under 4 h.p. the average cost of installation was £3 6s. 8d., and for larger motors £4 6s. 1d., but the cost per h.p. of the former was £1 19s., and of the latter 15s. 4d. At the present time a farmer can purchase and install a 2-h.p. motor for about £8 or £10 and a 5-h.p. motor for from £16 to £18. Costs of maintenance are negligible. Farmers who have had experience with electric motors state that they are entirely satisfied with the results obtained.

The second kind of appeal which electricity has for agriculturists relates to their living as distinct from their business, and in the farmhouse this form of heat and light is becoming almost indispensable. Work, both domestic and farm, must often be carried into the dark evenings of the winter, although the existing artificial illumination is often inadequate. It is perhaps as a source of heat that electricity can render the greatest service to country people. In the preparation of meals, the country woman is at a great disadvantage; it is not uncommon on farms for the women to have the care of the dairy and poultry, as well as the domestic work; but the electric cooker has enabled some of the disadvantages to be overcome. Perfect regulation of the heat is possible and this removes the necessity of continual attention.

Mr. W. H. Jones is a member of the staff of the Department of Agricultural Economics, University College of Wales, Aberystwyth

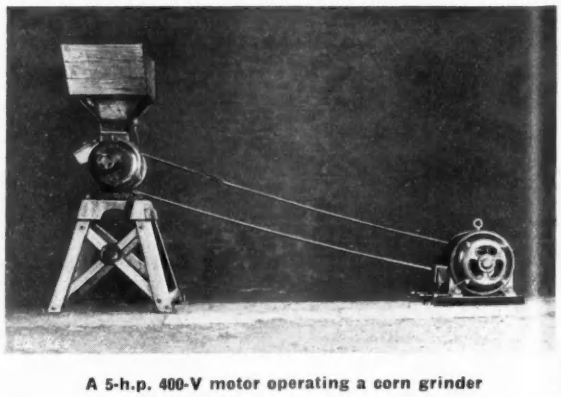
The cost of wiring the farm house will vary *inter alia* with the thickness of the walls, the distance between the lights and the quality of the materials used. Wiring on a comparatively extensive scale, although it results in a heavier outlay, tends to give a lower figure per lamp. The following figures relate to eleven houses:—

COST OF WIRING

Size of house.	Average No. of lamps.	Cost of wiring per house.	Cost of wiring per lamp.
		£ s. d.	£ s. d.
2-6 rooms	3	7 15 0	15 6
7-10 rooms ...	6	12 15 6	14 7
Over 10 rooms ...	12	13 2 0	11 9

The problem of supplying electricity in rural areas should be considered from the undertakings' as well as from the farmers' point of view. Progress will be determined by the extent to which they understand and are in sympathy with one another's difficulties.

Electricity can be introduced with considerable advantage in many farm operations, but the transition must be guided so that the outcome is of undoubted benefit to the farmers. Agriculturists should not lose sight of the fact that in order to get electricity at a low rate per unit, they must be prepared to take comparatively large quantities; moreover for their part the companies should realise that if they wish to cater for a relatively heavy demand from the country they must be prepared to offer electricity at an attractive rate.



A 5-h.p. 400-V motor operating a corn grinder

The accompanying illustrations were supplied by the South Wales Electrical Power Co.

Educational

The Manchester Municipal College of Technology has issued a prospectus of short courses of lectures and laboratory work to be given during the summer. The summer evening classes commenced on June 12th and the lectures are to include electrical and mechanical engineering subjects.

Cable-making Progress. By C. J. Beaver, M.I.E.E.

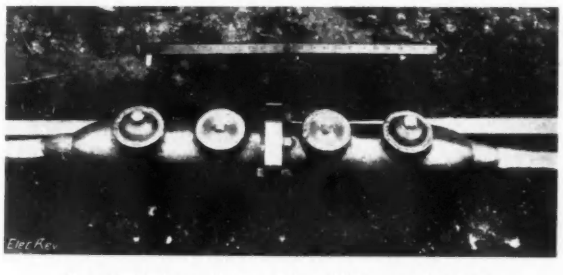
The problems raised by extra high voltages

THREE years is a comparatively small space of time in relation to the normal rate of development of an old established industry, and as this is the period which has elapsed since the writer was last invited by the Editors to comment on this subject (May 30th, 1930), it is proposed to refer chiefly to trends of development in the direction of lowering the costs of high- and low-voltage underground cables. Naturally, in the present period of world-wide depression, the greatest interest centres in aspects of progress which tend to foster commercial efficiency in the distribution of the electrical power rendered available by the grid system.

In the grid itself, the high-voltage requirements have, all things considered, been fairly well served. In the network, sturdy British standard construction has given thoroughly reliable results, while both for this and for low-voltage distribution, efforts resulting in a revised British Standard Specification for cables for all pressures up to 20 kV have been made, which it is hoped will prove to be of material economic assistance to all branches of the electrical industry. In this step the central authorities and the distributing and operative interests representing the user, have co-operated with the maker, and their joint conclusions as to the permissible reduction of dielectric and lead sheath thicknesses—and consequently of cost—constitute no mean effort towards the desired economy.

Mechanical and Electrical Factors

It will be appreciated that over the range of low pressures, say up to 6 kV, the considerations are largely mechanical, with electrical properties coming more prominently into the picture as the voltage increases. The necessity for the above-mentioned co-operation of the user is therefore clear, because the mechanical treatment of the cable on which the maker has to some extent sacrificed his margin of electrical safety becomes important. At higher voltages electrical considerations preponderate more than formerly, and here the benefits of experience in the building of super-tension cables come in, enabling the maker to obtain greater electrical efficiency than heretofore.



A straight-through joint of a 66-kV gas-filled cable

With regard to the high-voltage (132 kV) transmission lines of the grid, with one notable exception in which the Pirelli oil-filled system has been given an opportunity, these have been exclusively (and of necessity) of overhead construction, but there are distinct signs that developments in the manufacture of insulated cables may permit of a serious review in the near future of the relative positions of the cheaper initial construction and appreciable maintenance cost of the overhead line, with the improved initial cost of the underground cable and its possible reduction of maintenance charges. This, of course, must turn on the question as to whether sufficient advance has been made in cable manufacture. Beyond recently published accounts of work on the "pressure" cable, in papers prepared by Dr. E. Bowden and Mr. F. W. Main in which a three-core cable of the ordinary type is enclosed in a pipe filled with gas under pressure, little has been publicly stated regarding other developments in high-voltage cable until the recent discussions in various parts of the country on Mr. Dunsheath's I.E.E. paper on "Ionisation in Cable Dielectrics."

The outstanding and irresistible conclusion to be drawn from Mr. Dunsheath's able presentation of all the facts bearing on the origin and development of ionisation conditions in cable dielectrics was that they all had a physical origin, and it was not surprising therefore that the latest proposals for prevention of ionisation described by various contributors to the discussion should have very definite physical bases. For example, Mr. P. V. Hunter referred to a means of taking care of the effects of expansion by making the conductors and insulation in a three-core cable oval in cross-sectional shape, so that on heating by load, the axial dimensions altered to effect some volume accommodation for expansion.

The Gas-filled Cable

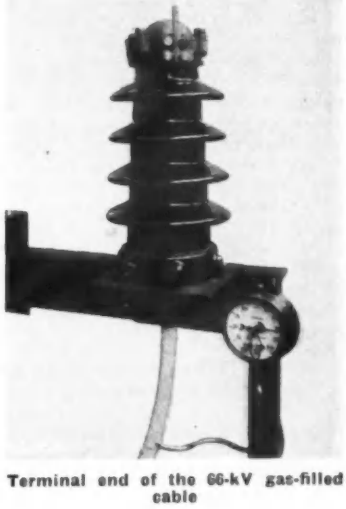
The writer's proposal in this direction was one which appeared to many to be revolutionary, although foreshadowed in his article of three years ago. In principle it (*a*) accepts as unavoidable the presence of gas spaces; but (*b*) deliberately designs them as regards dimensions (*c*) establishes them under such conditions of gaseous pressure that they are not ionisable up to a predetermined electrical stress, *e.g.*, twice the working stress; and (*d*) permanently maintains the designed gaseous conditions (*b*) and (*c*)—and thereby the electrical stability of the dielectric — by enclosing the gas spaces between the convolutions of paper impregnated with a compound which is physically stable up to temperatures considerably higher than those producible by working conditions.

[*Lafayette*

Mr. C. J. Beaver (W. T. Glover & Co., Ltd.) is a leading authority on cable matters

In addition to the facility of providing at will for complete absence of ionisation—synonymous, as Mr. Dunsheath pointed out, with deterioration—up to a predetermined stress value, this construction provides for complete accommodation at constant volume for all expansion occurring within the cable, thus avoiding sheath distension with its attendant production of detrimental modification of gas space dimensions and pressure. Neither of these facilities has been provided before in a self-contained cable, and they obviously strike at the very root of all the causes of deterioration and failure through ionisation in high-voltage dielectrics. Ample evidence was given regarding practical results under heavy loading cycles and high electrical stresses, and under these conditions perfect electrical stability was shown to be attained on factory lengths of cable when laid and jointed. These tests represented far longer periods and more severe conditions than those usually employed for "long-time stability" tests and for time/voltage breakdown investigations by cable makers.

Space does not permit a detailed description of these test results, but it may safely be said that they demonstrated the dawn of a new era from the point of view of definite reliability of super-tension cables, because the bugbear of ionisation is definitely eliminated, and this, moreover, with a margin of safety which is accurately predeterminable by the gaseous conditions in the dielectric.



Terminal end of the 66-kV gas-filled cable

Results of Tests

One example of a time/voltage test may be briefly quoted to illustrate this point. A factory length of 0.2 sq. in. 66-kV cable insulated to a radial thickness of 0.150 in. (less than a quarter of the ordinary thickness), and having 2½ mil. nitrogen gas spaces at a pressure of 200 lb. per sq. in., was maintained at voltages exceeding the designed working voltage in order to get certain maximum stress conditions in the dielectric, *viz.*, 120, 140 and 160 kV/cm. (Normal values in ordinary 66-kV cables are of the order of 45-50 kV/cm.)

The cable, which was laid and jointed, was subjected to the first-mentioned maximum stress value of 120 kV/cm. for 1,000 hours; then stepped up to 140 kV/cm. for a further period of 1,000 hours. During the whole of these periods load cycles were applied five times per week, to attain a conductor temperature of 65 deg. C.—a total of 64 cycles. Periodical ionisation tests were made, showing a perfectly flat power factor/voltage characteristic throughout the test period, *i.e.*, complete absence of ionisation.

At 160 kV/cm. a breakdown occurred in 3½ hours, indicating that the time/voltage curve possessed the much-desired property of being definitely asymptotic to a predesigned value of electrical stress. It may be noted in passing that an economical 132-kV cable need entail no higher maximum stress value than 120 kV/cm. under these conditions of design, and a similar demonstration at this voltage is in progress.

It is seldom in the history of technical advances that a considerable improvement in reliability and performance is obtainable without increased cost and complication, or without entailing the use of expensive supplementary gear, as, for example, in the case of the superiority attained by the oil-filled type of cable over the ordinary type for very high voltages. The gas-filled cable is a notable exception because, in addition to its cost being appreciably less than any other type for the same duty, it is a definitely simplified, self-contained cable, sealed off under its designed gas pressure, and jointed and terminated in perfectly simple fashion without feeding or compensating devices of any kind.

Photographs of a straight through joint and a terminal end respectively, as used on 66-kV gas-filled cables, are reproduced herewith. They are found to give satisfactory service under high values of temperature, gas pressure and electrical stress, in spite of their simplicity and relatively small dimensions.

With regard to *general* progress in the cable industry, a good deal might be said, if space permitted, with regard to recent improvements in manufacturing processes and machinery, and their influence in many directions on the improvement of the products; and the same remark applies to developments in materials and manufacturing technique. The scope in these matters is enormous, and without being too complacent the writer ventures to think that the electrical industry need not be ashamed of the general response made to its demands by its subsidiary—the cable industry.

Distribution System Protection. By R. O. Kapp, B.Sc., M.I.E.E.

Economical methods of ensuring a satisfactory standard of security

MOST e.h.v. networks serving important distribution centres are fully sectionalised by suitably disposed oil circuit-breakers. It suffices to open these at the two ends of the section in order that the line may be completely isolated. When this is done supplies are still maintained if the distributing centre at each end of the section can be fed from an alternative source, which may either be another incoming line or a local generating plant. Such complete means of isolation of individual line sections without interruption of supply are needed if it is essential to maintain continuity of service during any repair work or periodic overhaul and inspection of lines. Where switching arrangements of this kind are provided, selective protection of each line section can be added at the cost of the protective apparatus and pilots.

Complete selective protection cannot be supplied so cheaply to distributing systems serving comparatively small loads. Such systems, whether they be in urban or rural areas, will be tapped to supply the needs of small consumers or groups of consumers. Low power transforming points may be introduced for the requirements of a hamlet, a block of houses, or even a single building or farmstead. The inconvenience to consumers of a total shut-down must be balanced against the cost of ensuring that it shall not occur. Generally it is in the interests of the consumers themselves that they shall have their electricity as cheaply as possible, even with the drawback of occasional shut-downs, rather than that they shall pay heavily for the small additional benefit of almost perfect continuity of supply.

These conditions are best fulfilled if the smaller loads are supplied through the simplest and cheapest possible tapping points consisting of single transformers protected and isolated by means of switch fuses. Whenever a line tapped in such a way is disconnected either due to a fault or for overhaul, repair or ordinary maintenance purposes, the consumers are dependent on the tapping point or are without a supply. The longer the line and the greater the number of such tapping points, the more often will this happen. It is therefore advisable to sectionalise an extensive tapped distributing system by oil circuit-breakers at intervals. The section points should be at the most important loads and should be equipped with duplicate transformers, one on each side of the section switch, so that these loads may be ensured continuity of supply. These sectionalising points should be equipped with some form of discriminating protection.

When Fault Currents are Small

The protection must not be very sensitive or the loads tapped off the line will operate it. It can only distinguish faults from these loads by the strength of current flowing. Unfortunately the margin between fault current and load current is not always very great on networks of this type. They are frequently fed through at least one, and sometimes several, transformers in series; these introduce so much impedance into the circuit that fault currents are comparatively low. Thus there arise special problems of protection to networks of the kind we are considering.

Where there is sufficient margin between fault and load currents at all times, and the system is reasonably simple, a time graded form of protection, such as distance protection, or a combination of directional and overload relays with suitably adjusted time delays, is the most suitable because it is the cheapest. But it has the serious drawback of leaving faults on for longer than is desirable.

So long as the number of consecutive sections to be protected is not too great these time-grading methods give sufficiently good clearance. On long radial feeders or ring mains with many sub-divisions much can be done by adopting some type of pilot protection on individual sections. This substantially reduces the time settings for the remaining sections fitted with time-graded protection. Many methods are now available which utilise inexpensive pilots. The McColl system of balanced protection has been worked over a single bare bronze pilot wire strung on the overhead line poles, and the Translay system has been employed successfully on a privately owned telephone line without appreciably affecting the quality of the speech.

[*Elliott & Fry*

Mr. R. O. Kapp is a member of the staff of Messrs. Kennedy and Donkin

The interlock, lock-in, and duplex systems of protection have all been developed for use with telephone lines. They all require a source of potential, and this increases the cost of the equipment substantially, unless such a source is made available for other purposes as well. Generally potential transformers with a neutral connected to earth must be provided, but at least the duplex system operates equally well if supplied with potential derived from an open delta two-phase potential transformer, or even the lower voltage side of any power transformer in the station.

Earth wires with embedded pilots have recently been considerably developed. An experimental length that was erected in 1929 and has been kept under constant observation has shown no defects during this period. Recently earth wires have been constructed containing as many as four separate insulated cores; they can be used simultaneously for the protection of double circuit lines and telephony, and other purposes.

The difficulty of low fault currents mentioned above can often be overcome by inter-tripping the circuit-breakers at the two ends of a section. It is frequently found on ring mains or interconnectors that ample current is fed to the fault from one end, so there is no difficulty in clearing it. But after clearance the fault current fed from the other end is too small to operate the protective relays. Where a pilot is provided this can be employed for inter-tripping, so that the circuit-breakers at both ends always come out together.

By the addition of suitable relays such inter-tripping can be superimposed on the McColl, Translay, interlock, and lock-in systems. The duplex system is in itself an inter-tripping one and requires no additional gear for this purpose.

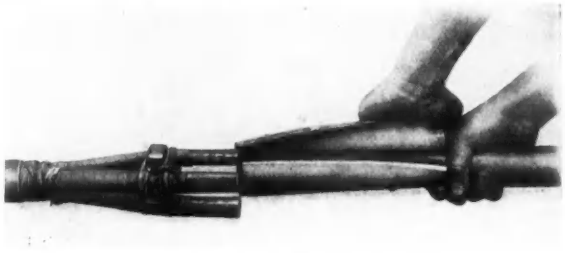
Cable Jointing. By J. S. Simmonds

What to do and what to avoid

Mr. J. S. Simmons is with W. T. Henley's Telegraph Works Co., Ltd., and is editor of that company's journal "Distribution."

THE factor of safety of a cable run is determined very largely by the electrical efficiency of its weakest joint, which depends on (1) the design of the joint box and (2) the degree of skill of the jointer. Information on cable jointing is scanty, but two very useful books on the subject have been produced: "The Art and Craft of Cable Jointing," by C. G. Watson, M.I.E.E., and "Practical Cable Jointing," by W. T. Henley's Telegraph Works Co., Ltd. My purpose here is to give a brief practical survey of the art and craft of the cable jointer.

The jointer's kit must be as comprehensive as possible, subject to the limitations imposed upon him by constant travelling, for a jointer is very rarely able to send to a nearby depôt for forgotten tools or jointing materials. A watertight covering is essential for sheltering the joint hole, and tents are always to be preferred to a sheet of tarpaulin. They should



The cutting and removal of the lead sheath

be treated carefully during transport; wear and tear on tents of the folding type can be greatly reduced by packing sacking or paper between the folds of the fabric.

Amongst the equipment required for the preparation of the jointing material is a regulation fire-devil with a wide fire area and which gives a flat type of fire. Coke is the best fuel for heating compound and jointing materials, as it gives a good bright fire over a wide surface. Coal is not successful; the smoke is injurious to the compound and jointing materials and leaves a sooty deposit on the vessels. The use of fires in improvised oil drums is not recommended, for after a little use they are liable to collapse with the risk of serious accidents due to the splashing of hot compounds and metals. The wide type of fire saves time, as two or three buckets of compound can be melted at once; experience shows that in many respects it is preferable to a primus stove.

Setting and Bending of Cables

The cables should first of all be placed in the position they will finally occupy so that they can be accurately cut and the joint thereby arranged in correct position. Where the cable is laid along a straight run it is a comparatively simple matter to set the cables, but where the joint has to be made on a bend, in a congested space, in a brick pit, or any other awkward position, much greater care must be exercised. Low-voltage cables should never be bent to a radius less than ten times their overall diameter. For higher working pressures the safe bending radii vary, according to the type of cable, between twenty-four and forty times the overall diameter. Where there is any doubt it is wise to consult the manufacturers.

The colouring of folded white paper plunged into the molten metal acts as a guide to temperature. Light brown indicates the correct temperature for a small wipe and dark brown for a large one

There is a tendency when bending cables to twist them in such a way that the internal formation is disturbed. It is even possible to crack the insulation, and in higher voltages this will inevitably lead to a breakdown. Heavy cables should be bent before the armouring is removed, as otherwise there is a risk of injuring the lead sheath where the armouring terminates. In cold weather it is advisable to warm cables slightly before attempting to form a comparatively sharp bend. This also has the effect of reducing the strain on the dielectric. Local overheating should be avoided. The setting of the cable prior to jointing should also be such that all "spring" is taken out of the cores so that there is no tendency for the cores to move out of position; for this reason a joint should never be made on a bend because the cable cores are strained and in the course of time may become displaced and so precipitate failure of the cable.

Where heavy cables are drawn into ducts joint boxes should be supported on straight brackets so that the joints are free to move under the influence of cyclic variations in temperature due to load. As much free cable as possible, therefore, should be allowed on either side of the joint. Where plain lead sleeve joints are used unprotected by a cast-iron shell they should be placed in metal cradles to prevent possible damage to the sleeves. It is also desirable to fit a lead bell-mouth round the cable duct where the cable emerges.

Jointing Materials

Jointing materials fall into two classes—those which are pre-impregnated at the manufacturer's works and packed in compound in hermetically sealed tins and those which have to be impregnated on site. Great care should be exercised to ensure that the latter are not overheated as their physical properties would thus be seriously impaired. The compound usually employed for impregnating tapes is of a resinous nature which may disintegrate when the temperature exceeds 280 deg. F. All insulating tapes, either fabric or paper, should be made into

When sweating a service joint a paper chute should be used to guide the flow of solder

small rolls for heat treatment, for in this form they are more efficiently dried and immersed in the compound. The tapes should be uniformly heated until all frothing ceases (approximately 250 deg. F.), which is the only indication that all moisture is expelled. After the frothing has stopped the vessels should be removed from the fire and the materials allowed to cool while still immersed in the compound to a temperature at which they can be handled conveniently. Heating after frothing ceases serves no useful purpose and involves a risk of spoiling the materials, which should not be taken out of the compound until required for use as moisture may be reabsorbed.

Where the manufacturer supplies pre-impregnated jointing materials in hermetically sealed tins filled with compound, treatment on site is not necessary. All that is required is the gentle heating of the tin before the materials are removed. They should not be unduly exposed to the atmosphere after removal and, as in the case of materials treated on site, they should be kept immersed in the cool compound pending their use. This treatment should take place shortly before the materials are required for use.

Compounds are supplied either in buckets or tins; for storage and handling, tins are much more convenient. Where the compound is already in a bucket this can be placed directly on the fire and the compound poured straight out of it. The tin should be carefully removed by cutting off the top and bottom

with a hack knife, splitting the container down and stripping off the remainder. On no account should more than this final cut be made, otherwise small pieces of tin may find their way into the compound and eventually into the joint. The bucket must be free from carbonised compound left over from a previous occasion. When melting compounds the bucket should not be placed directly on the fire but should rest on bars or a thick sheet of iron interposed between the bottom of the bucket and the fire in order to secure even distribution of heat and prevent local overheating. Stirring the compound while it is melting is recommended. It is not advisable to guess the temperature—a thermometer should be used.

After all the compound has melted, if crackling or frothing (which indicate the presence of moisture) are observed, careful heating and stirring at a temperature of 225 deg. F. must be continued until it ceases. If it does not cease within a reasonable time the compound should be rejected. Compound held in stock should be kept clean and dry.

Compound Filling and Bonding

When a compound is at pouring temperature expansion by about 5 per cent. to 10 per cent. has taken place, and in cooling it shrinks to its original volume. Under operating conditions expansion and contraction of the filling compound take place according to the range of temperature variations, and all boxes should provide for this. In some cases boxes are filled with compound in two operations. In no circumstances should the second filling be cooler than the recommended pouring temperature. If cooler compound is used very little shrinkage will take place inside the box and there will be no room left for expansion under full load. Thus with sealing boxes for a 33-kV cable mounted on an outdoor transformer and containing 50 lb. of compound and exposed to the full heat of the summer sun the temperature might easily rise to 110 deg. F. Assuming the box is completely filled with compound at 60 deg. F. expansion would be as much as 20 cu. in., and the pressure generated by this expansion would burst the casting if it happened that there were no other means of relief.

Experience has proved that many joints are ruined at the outset by the use of plumbers' metal which has been heated repeatedly. This practice is wrong, for the metal tends to become rich in lead, resulting in a porous wipe. Unsatisfactory plumbing metal is sometimes doctored on site with tin. Rather than take any risks doubtful metal should be rejected in favour of new clean metal of a reliable brand. Porous wipes are not always immediately apparent; it may take years for sufficient moisture to enter the joint and thereby cause failure, but it should be remembered that the heating and cooling of a cable under load produces a breathing effect, ingress of moisture through a porous wipe will inevitably occur.

In any type of joint particular attention should be directed to the bonding of the armouring and the lead sheath. In most modern designs the manufacturer provides suitable bonding arrangements in the design of the box, but small details such as the removal of paint and dirt from the contact surfaces of the boxes are easily overlooked. An efficient bond is very necessary, as a high resistance bond may cause arcing between the armouring and the lead sheath, resulting eventually in puncturing the lead sheath. These conditions are likely to occur particularly in situations where considerable potentials are picked up in the ground by the armouring of the cable and on systems subject to heavy fault currents.

Power Factor and the Consumer. By E. H. W. Banner, A.M.I.E.E.

CHARGES for electricity supply frequently necessitate an explanation to the consumer as to the means of arriving at the correct charges. Difficulty is often found in this, particularly when there is a power factor clause. As the following explanatory analogy seems to be simple and easily understandable, at least by the sort of prospective consumers likely to be negotiating for power supplies for factory use, it is offered as a suggestion. A more elementary difficulty often met is in connection with watts, amperes, and volts. The formula watts=volts×amperes is certainly simple, but a more convincing explanation, and one that forms a basis for the power factor analogy, is to remember that watts are power and volts and amperes merely mathematical components of power, representing no power or physical quantity by themselves.

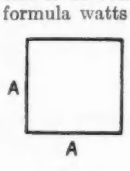


FIG. 1.

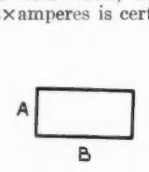


FIG. 2.

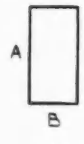


FIG. 3.

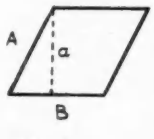


FIG. 4.

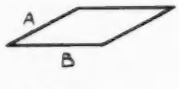


FIG. 5.

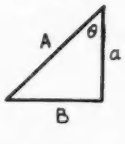


FIG. 6.

Imagine a man buying land: he buys so many square yards and he may have a square, a circle, various shapes of rectangle, or any irregular shape. If the square of side A (fig. 1) is considered its area is A^2; similarly in figs. 2 and 3 the area is AB, where A and B are different for the two cases. Now it will be realised by the prospective purchaser of the land that what he is paying for is area, not length or width, and that the components A and B may vary unlimitedly, but still maintain the same area.

The electrical case is watts=volts×amperes, similarly to area=length×width (A×B in the figs.).

Power may be considered as area, and volts or amperes alone as having no real value; only their product is a finite and real quantity. For alternating current the same thing holds, provided the circuit is non-reactive and so has no angle of lag between volts and amperes, otherwise called unity power factor. Where there is a phase angle between volts and amperes (which may be either leading or lagging), the straightforward multiplication of volts and amperes is no longer correct, but the analogy can be extended to cover this case.

With the four-sided figure (a rhombus) in fig. 4, the area is no longer A×B, but a×B, where a is the perpendicular distance from the base. Figs. 4 and 5, although having similar values for A and B, have obviously very different values of area, as can be seen by the length of a in the two cases. Applying the analogy to the electrical case, again A and B represent volts and amperes and the area represents power or watts.

As in the analogy A×B does not equal the area, unless A is perpendicular to B, in which case figs. 1 to 3 are reverted to, neither do volts×amperes equal power or watts, but the product a×B does equal watts. In the limiting case of zero power factor, a is zero and the power is zero, whatever the components of volts and amperes may be. The requirement is to show that the length a is A cos θ, where θ is the angle between the line A and the perpendicular to B. In the electrical case the angle is called ϕ so that we may state watts=volts×amperes×cos ϕ, in the same way as in the analogy area=A×B×cos θ (fig. 6).

The term cos ϕ is known as power factor. Electrically, a wattmeter measures V×A cos ϕ directly, or if a voltmeter and ammeter are used a power factor indicator is also necessary. As with most analogies it is not safe to take a literal interpretation always; in this instance there is the very serious objection that area is composed of the products of two lengths at right angles, whereas for the electrical case true power comprises volts×amperes in phase. This drawback must not be lost sight of, as although it need not deter the layman from understanding sufficient of the subject for his purposes, yet if he proceeds to vector diagrams and finds that two vectors of volts and amperes at right angles are equal to zero power he will not be easily reassured as to the fundamentals.

X-ray Boiler Examination

A RECENT X-ray examination of one of the boilers of a large vessel belonging to a well-known shipping line saved a good deal of time and trouble. The boiler was found to be defective and leakage from cracks between the rivets was suspected. In the past this kind of flaw was verified and investigated by grinding and etching, and, if necessary, photographs of the structure were taken. Although a crack can be traced through the material to the end, this method involves a great deal of time and considerable expense. The X-ray examination was carried out with Philips "Metalix" apparatus, operating at 155 kV and 1.6 mA, and the high voltage cables from transformer to tube were 10 yards in length. The transformer was placed on the deck and the tube was brought into the boiler. The radiography of the spaces in between the rivets did not present any difficulties, although only one man could get inside the boiler. The holes in the water tubing system were filled in with tungsten clay so as to avoid over-exposed areas on the film. The boiler plates were approximately 40 mm. thick. Reference marks of tungsten wire were used. In some areas it was found desirable to take stereoscopic pictures in order to establish the depth and extent of the cracks.

Power-factor Correction. By Philip R. Coursey, B.Sc., M.I.E.E.

The economic value of condensers

POWER-FACTOR improvement is economic to the consumer and to the supplier, but many things influence the degree of economy it may achieve. Foremost among these are the nature of the load, its diversity and variability, as well as, from the consumer's point of view, the nature of the tariffs imposed.

Many industrial factory loads to-day have an exceedingly low power factor, and reduced production output in the present times aggravates this defect. Power factors well below 0.5 are much more common than they should be, and the more than doubled current thereby entailed demands that measures be taken for its reduction.

For the majority of consumers the static condenser offers the simplest solution, as it does for many distributors by its use in sub-stations. For almost wholesale power-factor improvement at large distribution centres the synchronous machine scores heavily on the basis of prime cost, but the cost of its much higher losses and maintenance must not be overlooked. For the unattended sub-station, even of large size, the static condenser must be considered particularly valuable.

[*Elliott & Fry*

Mr. P. R. Coursey is technical director of the Dubilier Condenser Co. (1925), Ltd.

The already much-debated question of whether the distributing authority should apply (and this implies also purchase) the apparatus for the power-factor improvement, or whether it should rather impose such a tariff as will encourage—nay, rather, compel—the consumer to install the apparatus is one which no amount of writing will probably ever settle. Doubtless we shall always have adherents to both views, since two of the most potent considerations are of directly opposite character—namely, the crying need for much simpler tariffs that can be understood and worked out by every consumer without the help of both engineer and an accountant; and the great desirability of relieving all parts of the system, including consumers' transformers and switchgear, of the wasteful idle current. The former desideratum would at least be encouraged by centralised correction, while the latter calls for diversity.

As an advocate of the widest application of condensers, I naturally lean to the second of the above alternatives, but at the same time I would utter a plea for the elimination of the complexity of many of the existing tariffs intended to encourage reduction of idle current by maximum-demand charges or power-factor penalty clauses.

Could not everything be met by a straightforward flat rate per kilovoltampere-hour, which enables the consumer to pay for the energy he takes, automatically encourages him to take it as near unity power factor as possible, and gives him only one metered figure and rate to work with? Such a tariff would encourage also the installation of condensers in such a form that they are taken off circuit with the motor load, and the drawing of large leading currents, which at times of light load tend to raise the voltage to the detriment of lamps on the same circuit, would be discouraged.

From this point of view the most straightforward applications of condensers are with individual motors, switched by the motor control itself, the condenser being connected directly to the motor or motor main control switch. Alternatively, the special a.c. motors built to operate at high power factor can be used, but their cost is generally above that of the condenser-induction motor combination. Except for large motors, the small size of the condenser required for individual correction means, however, a higher basic cost; for an average factory this type of installation may easily cost 50 per cent. more than a single condenser designed for the same total power-factor correction, applied to the main busbars of the factory.

There are two alternative modifications of the arrangements whereby a similar result can be achieved without as much cost increase as the separate-condenser method involves. When some manual attention is available a single large condenser can be installed at any convenient central point in the factory, and provided with switchgear mounted on or close by it, whereby its reactive output can be controlled over wide limits. By switching various sections in and out the power factor can be kept by the attendant at or close to any desired figure. This attention can be supplemented by a bell alarm device connected to the load circuit, whereby an audible warning is given if the kVA is excessive (as when the tariff includes a maximum kVA demand charge), or if the power factor is too low (as for tariffs with penalties for low power factor; or kVAh tariffs). As a further refinement, the sub-dividing switchgear can be replaced by contactors, or by electrically operated switches, whereby certain sections of the condenser bank are put into circuit automatically whenever any given motor or group of motors is being used.

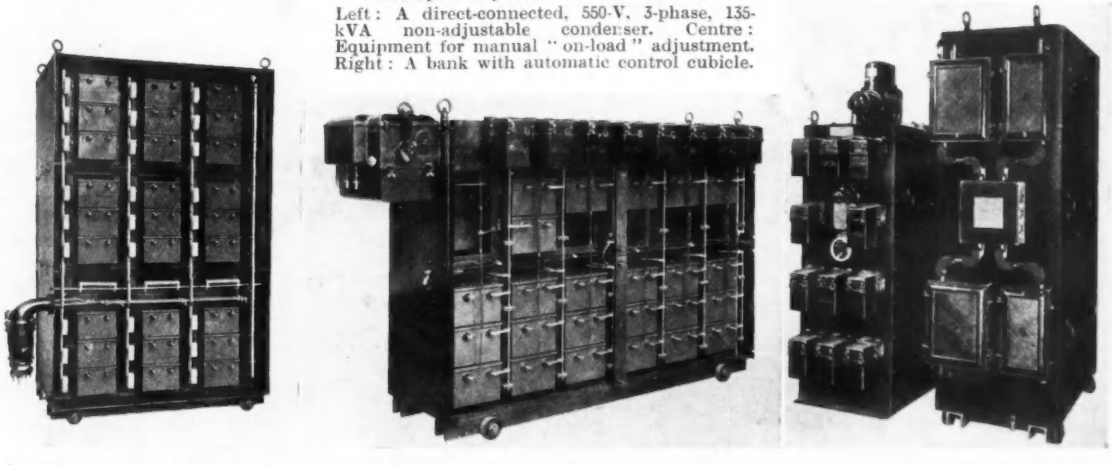
Special Arrangements for Neon Tubing

The growth of the use of neon or gas-discharge signs for advertising purposes has introduced a problem in that their power factor is usually very low, requiring a condenser often out of all proportion in size to the remainder of the load. This condenser must usually be switched off with the sign, or it may take a larger kVA demand by itself than does the whole plant when operating normally. An automatically switched condenser bank is quite useful in such cases. If such precautions are not taken in installations of this class all the economies expected from the use of the condenser will be lost. Provided that the switchgear used with the neon sign is of a type suitable for handling the switching surge currents of the condenser it is simplest and safest to use individual correction for the sign quite distinct from the remainder of the installation. Many of these signs now have condensers installed as an integral part of their construction.

A solution of bad power factor arising from a large number of small single-phase motors is found in the so-called capacitor motor which is now being used for refrigerators and such-like duties. In these a condenser is permanently installed which provides the necessary power-factor improvement and also makes the motor self-starting by a split-phase connection. Where a supply district has many fans, refrigerators, and other such appliances installed, the use of condensers becomes imperative if full use is to be made of the distributors.

Examples of p.f. correction condensers

Left: A direct-connected, 550-V, 3-phase, 135-kVA non-adjustable condenser. Centre: Equipment for manual "on-load" adjustment. Right: A bank with automatic control cubicle.



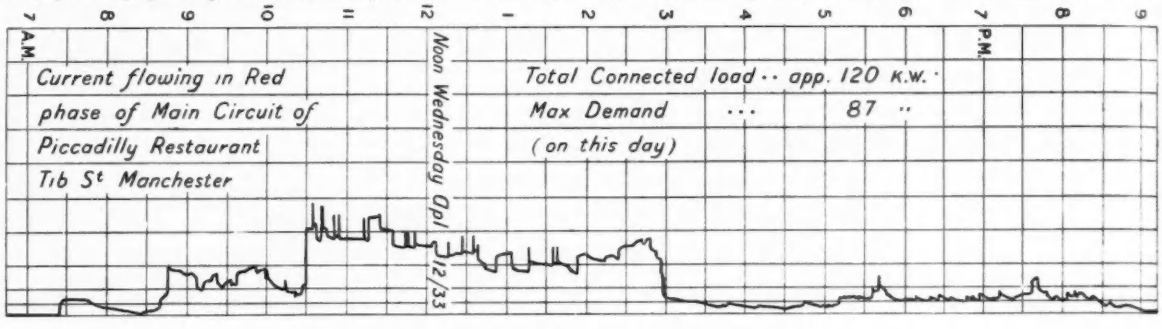
The Power Canvass. By W. E. Swale, A.M.Inst.C.E., A.M.I.E.E.

The electricity salesman's golden opportunity

IT is nearly two years since the ELECTRICAL REVIEW with its leader "Canvass the Country," made a meritorious effort to set a great national sales campaign in motion. The 1933 "Convention Number" forms a fitting opportunity for focusing fresh light on the vital subject of selling electricity.

If the editors of the REVIEW and those who supported them expected any startling new movement on the lines suggested, they must have been disappointed. A few enthusiasts wrote encouraging or critical letters, and in the ensuing months a number of instructive articles dealing with various aspects of load building appeared in these pages. Then silence fell; everyone interested became submerged in his own particular problems, and, for all one knows to the contrary, the "National Canvass" has died unborn.

The electrical Press, with a laudable desire to keep all parties concerned up to scratch, has suggested consistently for years that, generally speaking, electrical development in this country is not progressing as fast as it might. In the last three years, however, in acute trade depression and exceptional business uncertainty, the output of electricity has increased by 5.6 per cent. (1930), 4.5 per cent. (1931), and 7.4 per cent. (1932), a record which has not been approached by any other country in the world. In a paper recently read before the Institution of Electrical Engineers, Mr. J. M. Kennedy and Miss D. M. Noakes propounded "Some Suggestions as to the Causes of and Remedies for the Slow Rate of Development." In the ensuing discussions the authors were castigated by the spokesmen of the leading municipal and company undertakings for casting an unwarranted slur on the progressive policies adopted by all the more enlightened authorities. On mature consideration, and taking into account the inherent financial strength of our chief competitor, the electricity supply industry, as a whole, cannot fairly be accused of slacking.


7 8 9 10 11 12 1 2 3 4 5 6 7 8 9
A.M.
P.M.
Noon Wednesday Oct 12/33
Current flowing in Red phase of Main Circuit of Piccadilly Restaurant Tib St Manchester
Total Connected load .. app. 120 K.W.
Max Demand ... 87 ..
(on this day)

A typical load curve of a Manchester restaurant

Further Power Load Essential

Yet the need for getting still further power load on to our mains is obvious. There must be literally thousands of inefficient, in many cases quite obsolete, small power units still at work in our older industrial areas. Such loads have, on the aggregate, a high diversity, and form an essential balance to the rapidly growing domestic load.

All honour to those undertakings who, in recent years, have recorded astonishing progress in the connection of domestic load; but the very magnitude of this potential load has an inherent danger. A domestic "all-in" tariff sufficiently low to attract business rapidly carries only a very fine margin of profit, and is, furthermore, calculated on the assumption that the resulting demand is "off-peak" in relation to the basic power and lighting loads. It is not difficult to visualise a situation where, with a stationary "base load" and a rapidly increasing domestic load, the incidence of system peak will be altered, and the basis of tariff calculations entirely upset. Warnings of such possibilities have already been sounded by engineers in preponderantly residential supply areas.

The growing importance of the industrial heating load has been stressed in several recent articles and papers. A revival in the engineering trades will undoubtedly see rapid developments in this direction. The deterrent factor at the moment is not necessarily the cost of electrical energy, but the relatively high cost of electric furnaces. In the baking field, particularly where small ovens up to, say, 20-kW capacity are concerned, the prices of equipment are now very reasonable, and the number of electric baking ovens being installed is soaring.

Particular attention should be paid by supply authorities to the enormous field for large-scale restaurant and canteen cooking plant. The subject is essentially one that needs specialised treatment, but the potentialities of this load cannot be too frequently stressed. The desirability of the load from a supply undertaking's point of view can be judged from the load curve reproduced herewith. This illustrates the power demand of an all-electric restaurant in Manchester in which 120 kW of cooking and water-heating apparatus is in operation.

The Power and Heat Census

A census of "unwired" homes is already available. As regards industrial power and heat generated by sources other than electricity, it is probable that a considerable amount of data has already been collected locally by the sales staffs of supply undertakings. The ELECTRICAL REVIEW, which has taken this matter so much to heart, might perform a most useful service to the industry at large by instituting a national pool for existing data, as a preparation for another effort to cover the country completely. With the assistance of the I.M.E.A., the Incorporated Association of Electric Power Companies, and E.D.A., it should be possible to ascertain how much "unofficial" canvassing has already been done, and what the existing records show.

Though the results of a detailed national census would be of considerable interest, it is not the possession of *accurate figures* that is of such immediate importance. Rough estimates reveal that in Great Britain only 52 per cent. of the total electricity sold by supply authorities is used in industry, while at least seven million h.p. of primary steam plant, and more than three million kW of private electrical plant is said to be still in operation. The first need of the moment is to obtain at least some of this great potential load. Emphasis must be laid not so much on the mere collection of data as on the canvassing with its implication of *personal contact* with the prospective user. Two methods of approach which have met with success will be briefly elaborated.

Mr. W. E. Swale is a member of the staff of the Manchester Corporation Electricity Supply Dept.

Information and Demonstration

Every existing or potential power consumer should feel that the supply undertaking operating in his area is a keen, efficiently managed, commercial concern, and the highest authority available in all matters regarding the economic applications of electricity to manufacturing problems. Without an enormous sales staff it is impossible to keep in personal touch with all consumers; but much can be done with properly planned and distributed publicity matter. Judicious local Press advertising, effective sales letters accompanied by illustrated leaflets, and, best of all, a regular sales bulletin, will soon engender the desired reaction summed up in the words—"when in doubt apply to the Electricity Department."

Dealing with power and industrial heating sales particularly, the cardinal point to remember is that the publicity matter should *not* deal with generalities, but with local applications. The busy works manager in Lancashire, for example, may have little time to consider the progress of electricity supply in general; but he will be intensely interested in some new fea-

ture which is applicable in his own town and in his own business.

The cost of equipping a small demonstration workshop is not great, and the benefits of being able to demonstrate a new machine or system of working in one's own area are indisputable. The workshop should, of course, contain a permanent exhibition of good industrial lighting fittings, and can easily be arranged to show successively a great variety of power and heating apparatus. Industries for which profitable demonstrations can be staged include engineering (in practically all its branches), building, printing, tailoring and garment-making, boot and shoe repairing, baking and confectionery making.

The value of such demonstrations rests not only in the contacts made with actual visitors; the local Press is quick to seize on the news value of a fresh electrical application. In a surprisingly short time the initiative of the local electricity department will be noised abroad amongst all classes of consumers.

In a brief article one can hope to touch on only a few of the many aspects of sales propaganda. One question arising out of recent correspondence in the REVIEW deserves mention. Is a special Sales Development Association really necessary? Will it not merely lay a still greater burden of committee work and travelling, with imperfect digestion of amorphous sales ideas on the shoulders (forgive the bull!) of the men who ought to spend their time among their consumers? The industry has, in E.D.A., a thoroughly enthusiastic, and well organised, central propaganda organisation, whose work in recent years has provided a most powerful stimulus to all engaged in sales work. The younger and more impetuous members of electricity sales staffs should make the fullest use of the admirable educational matter regularly produced by E.D.A. (the recently instituted "E.D.A. Bulletin" deserves special mention).

The air is full of the most admirable "sales talk," and many methods of approach have been suggested and discussed. The best way now to help the industry and ourselves is to get out among our consumers, and prove by facts and figures what electricity will really do for them. Value, according to the economists, depends on two facts—scarcity and utility. Scarcity of our product, if local authorities follow up the work of the Central Electricity Board, will soon be a thing of the past. Utility is the factor which has to be proved to the consumer. Surely no salesman ever had an easier task.

Domestic and Commercial Tariffs. By Henry M. Sayers, M.I.E.E.

As the cost of electricity, including capital charges, varies widely with the utilisation factor of the plant provided, a uniform flat rate is impracticable either as a means to a favourable commercial result or to the rendering of the maximum public service. Detailed analysis of actual cases shows that the standing charge properly debited to each consumer is by no means a constant amount per kW of the consumer's maximum demand or connected load. Both in equity, and in pursuance of the commercial and public service objects of the undertaking, a good tariff should collect from each consumer an amount approximating to the ideal of being proportionate to the cost of supplying him.

While two-part tariffs are in use in the majority of undertakings, there is no approach to a standard method of assessing the fixed charge. The committee set up by the Electricity Commissioners a few years ago was unable to recommend an agreed basis, but it did recommend two-part tariffs as most suitable for domestic consumers. The success which has attended their adoption in increasing domestic electrification is a strong recommendation of the principle, although how far the success is to be attributed to the overall reduction in the cost as compared with the previous flat rates, and how much to the two-part feature may be a matter of opinion; I believe that the fixed charge is not attractive to the consumer. The most generally adopted basis for the fixed charge is rateable value, but tariffs based on floor area of living rooms, number of rooms, and number and/or wattage of lighting points are all in use.

Why Two-part?

Rateable value seems to have no logical connection with the true standing charges incurred in serving different houses. The others named have an apparent connection with the consumers' probable maximum lighting demand; if it be assumed that the consumer's lighting peak demands will coincide with the system peak there is a trace of reason in that assessment of the fixed charge. This assumption is becoming invalid by the changes in the character of the domestic load; one need only cite the Wimbledon experience pointing to the probability that the system peak may be on a Sunday morning to disprove the validity of the lighting basis.

For these reasons, among others, I doubt whether the two-part tariff is a permanent factor in promoting the maximum of domestic electrification. There is no discernible approach to standardisation, and no rational self-evident basis for the fixed charge part—"self-evident" in the sense of justifying itself to the average consumer. It is very doubtful whether any one of the tariffs in use will be legalised without giving the consumer the alternative of a flat rate, unless an obviously true measure of fixed charge can be demonstrated.

What, then, can be done to obtain a better basis, or, alternatively, a better form of tariff? When the engineer wishes to know the value to assign to a quantity for which there is no available information—he measures the quantity, perhaps by model or test-piece if full-scale material is not available. That is the right thing to do to find a defensible basis for a domestic tariff.

Fortunately, beginnings have been made. The most complete yet published is probably that of Messrs. Woodward and Carne's "An Analysis of the Costs of Electricity Supply and its Application in Relation to Various Types of Consumers." (see *Journal*, I.E.E., Vol. 71, p. 852, and Vol. 72, p. 358, for a valuable part of the discussion thereon). The authors made actual measurements of demand and consumption on sections of distributors serving consumers whose connected loads and consumptions were known. In conjunction with the costs of supply from the station end, these measurements, which took into account the internal diversity and aggregate load-factor of each group of consumers, permitted an accurate estimate of the cost of supplying the consumers, both with regard to the standing charges and the running costs. The measurements brought out some interesting facts about diversity factor, an element of great importance in assessing the standing charges. It is significant that the North-Eastern Electric Supply Co.—to which the authors are attached—has abandoned the two-part tariff.

Mr. J. N. Waite, in the discussion of the paper, gave details of the consumption and cost of supplying a block of 500 working-class houses in Hull. The houses are served by a sub-station which has no other load, each house has a cooker, wash-boiler, and lights totalling 8.6 kW connected load, or 4,300 kW for the 500 houses. The maximum load observed coincident with the generating station peak load was 100 kW; and the maximum load coincident with the local distribution peak was 160 kW, or 0.2 and 0.32 kW per house respectively. These observations show the remarkable diversity factors of 43 in respect of the station peak and of 13.4 in respect of the local distribution peak. The internal load factor over a year was only 20.3 per cent., but obviously the charge in respect of generating and distributing plant was very much less than would be calculated on the raw load-factors.

Mr. Waite also made an analysis of costs, divided into standing charges and running costs, and showed that the proper rate per kW of maximum demand of each house was 15s. per annum. The standing charge was 15 per cent. of the net rateable value, which works out at about 7s. 10d. per kW of maximum demand. The consumption rate of ½d. per kWh fully made up for the deficiency, and the supply gave a reasonable return to the undertaking.

Mr. H. M. Sayers

These illustrations show that measurement of the load conditions for specific classes of consumers is feasible, and that the results are serviceable for devising suitable tariffs for defined classes of consumers, which will be approximately correct as between different classes, and approximately of equal net earning power for the undertaking. That leads directly to a defensible tariff—*viz.*, classified flat rates. Each rate would include the element of standing charge found to be appropriate by measurement. Such a tariff would get over the objection to "paying

something for nothing" raised against the two-part tariff. It would simplify prepayment meters, not a small recommendation; it would simplify alterations in rates. It is easier to alter a rate per kWh than two rates.

It seems doubtful whether a good "yard-stick" for the fixed charges to different classes of consumers could be obtained from the measurements suggested, but there is no doubt at all that the measurements ought to be made. Every detail of cost and performance of generating stations is the subject of meticulous measurement and record. Distributing systems are rarely the subjects of measurement in any thorough way. Yet it should be possible to tell the efficiency of each part of the distributing system to trace all the losses which make up the collective difference between "kWh sent out" and "kWh sold." The information would be of a value that can hardly be guessed at.

A Method of Comparing Charges

Mr. D. J. Bolton, in the ELECTRICAL REVIEW of April 15th and 29th, 1932, made a very useful examination of two-part tariffs and their relation to the aggregate standing charges and total running costs of all the authorised undertakers in the country. Referred to kWh sold and consumers' maximum demand, the two amounts found are: £8.45 per kW of maximum demand and 0.206d. per kWh sold.

Mr. Bolton took the ratio 8.45/0.206 as a criterion for a true two-part tariff; the ratio is 40 approximately. Then he compared the aggregate of a large number of two-part tariffs applied to an aggregate load representing average consumers. The two elements gave a ratio of about 10; so that on the raw figures the two-part tariffs in use very much undercharge the consumers for the standing component, and overcharge for the running component. That coincides in kind with Mr. Waite's comparison between the rateable-value fixed charge and the true standing charges for the 500 houses, though the difference in Mr. Waite's case is substantially 2 to 1 instead of 4 to 1, as calculated by Mr. Bolton. But the latter goes on to show that, by reason of the diversity factor, his ratio of 40 would considerably overcharge consumers of low load-factor in respect of the fixed charge.

Mr. Bolton seems to the present writer to have made out a considerable case against the two-part tariffs now in use; at least he shows that two-part tariffs should be in multiple for application to different classes of consumers, just as I suggest flat rates in multiple.

Commercial Charges

Turning to commercial consumers, shop lighting has generally a low load-factor; the lighting hours can be calculated pretty closely, taking window and inside lighting separately. Whilst there will be a long range of load-factor as between different shops—mainly on account of window display—they will have the common feature of a simultaneous peak, daily, weekly, and annual, in any one locality. That makes a maximum-demand tariff rational and equitable. The basis of the kW charge should be determined by such an analysis as that of Messrs. Woodward & Carne, with proper adjustment for diversity factor, if any. At present the annual shop-lighting peak in most places coincides with—and helps to make—the annual system peak. That will make the kW charge pretty high, but looking at the "value of service" not unfair. Shop-lighting is perhaps the one class of load which can be valued as a money-worth service. The maximum-demand basis may very well be on the wattage installed, instead of being recorded. However assessed, the m.d. principle does away with the necessity for special after-closing window-lighting rates. Evidently the use of time switches for window lighting makes the calculation of load-factor easy.

Office lighting has, on the whole, a lower load-factor than shop lighting, but its peak is generally off the system peak. It seems that flat rates based on group measurements will be appropriate. Naturally, classification as between offices with lighting only, and with heating, &c., will be necessary. Workshops, factories, &c., are commercial, too, but in a different sense. In many cases electricity supply is in price competition with the factory's own plant, or with gas, oil or coal. Generally the maximum-demand plan is suitable; generally, too, the owner of such an establishment can see the justice of the plan. For such cases as bakers' ovens it may be possible to calculate closely enough to warrant offering a fixed price for a supply.

Where price competition is the main factor in getting business it is of the utmost importance to have accurate knowledge of *all* the costs—another reason for measurements on distribution systems.

Free Advertising for Electricity. By A. Hugh Seabrook, M.I.E.E.

A GREAT deal is heard nowadays of national publicity campaigns, but there are innumerable *free* sites for advertising electricity at the disposal of all electricity supply authorities. These free sites are rarely taken advantage of. Trades such as the soap and tobacco industries would willingly give at least £500,000 a year for the use of them.

Take, for instance, kiosks and sub-stations; it is rare to see any indication of their use, although occasionally the words "Danger—keep off" are painted on them in large letters. If they only had the words "Electricity Supply Sub-station" (or switch or control point, as the case may be), with the address of the showroom and office of the supply authority on them, they could be made to tell the electrical tale in a modest sort of way, but a little thought given to the subject suggests numerous methods by which these parts of the electrical system could be made more useful from the point of view of publicity, and to tell their tale in a way that would compel attention. For instance, the smallest could be fitted with a glass-covered show case in which electrical apparatus could be displayed, and from time to time announcements that the supply authority requires to make to the public. The larger buildings could have proper windows with more exhibition space. There need be no access from the window to the interior of the building.

Admirable efforts are now being made to ensure that these buildings harmonise with their surroundings, and the publicity advocated need not interfere with the design. Some of the new petrol stations show what can be done to make a hitherto hideous but necessary equipment attractive, and at the same time conspicuous.

Why should not the power station be made to tell the electrical tale? It is generally, or should be, so situated that a large neon sign fixed to it would not be offensive, considering the surroundings. Local authorities owning electricity supply undertakings have infinitely greater space resources than companies, because all municipal buildings and sites can be used for electrical publicity purposes, but, with a few outstanding exceptions, this valuable free advertising is neglected.

Another free advertising site is an enamelled iron plate fixed on factory buildings, indicating that they are driven from the electricity mains. In my experience very few refusals have been met with, because the factory-owner reckons it a bit of publicity for himself, indicating that the factory is run on up-to-date lines. The captious critic will say "What? Shall we plaster our power stations, sub-stations, and overhead lines with bills and posters?" That is not the suggestion at all: my proposal is that an expert publicist should be employed to advise the industry on this matter, and submit model schemes that can be circulated among supply authorities.

[*Elliott & Fry*

Mr. A. Hugh Seabrook, M.I.E.E., M.I.Mech.E., is a well-known consultant, who has had many years' experience of municipal electricity supply work

The very existence of the grid and its "pylons" indicates the presence of electricity, but in selected and suitable positions even the pylons might be made to tell the electrical tale in a more emphatic manner than they do at present and without offence. Where the services of the expert publicist would be also valuable is in camouflaging the outdoor transformer and switch stations that are springing up in so many parts of the country. These are truly terrible in appearance. They cannot be balanced owing to their design and construction, but fortunately few members of the public know what they are. I have heard people say, when suddenly meeting one of them in a beautiful part of the country, "What a peculiar place for a scrap-iron merchant to fix upon for his depôt!" It is quite possible for these erections to be rendered less unsightly, and they also could be used as free advertising sites to tell their electrical tale to passers-by.

Street Lighting Improvements. By C. C. Paterson, O.B.E., M.I.E.E.

Directions in which progress can be expected

LOW running cost has always been an important factor in street lighting, and with to-day's urge towards economy in public administration it tends to be chief amongst the considerations which weigh with lighting authorities. Nevertheless every authority is ready to weigh cost against the standard of lighting obtained for its expenditure, if only there is agreement on a criterion of excellence. Installations can be cheap and bad or cheap and good.

Much of the expert technical effort of the past five years has been directed to laying down standards of good lighting for streets so that lighting installations may be judged by their lighting as much as by their cost. The British Standard Specification for street lighting is the first effort of its kind to establish an easily applied standard or classification in terms of the light given by an installation. The Specification is not perfect, but it is a notable step forward on a difficult path and a valuable instrument to the hand of the lighting engineer.

How is the specification best employed? If the responsible committee has not a knowledge of the various classes of street, a useful beginning is a classification of the existing installations in the area. Then, when contracts are being discussed for the lighting or relighting of existing streets or for new installations the committee has established its "yard-stick" and can specify the class of lighting required in each case in accordance with this national standard. If it is fortunate enough to have a public lighting engineer who can advise as to the requirements, so much to the good, for there are details in connection with the type of lighting equipment and its arrangement which require settlement in addition to the street classification. To indicate the procedure of such classification a representative table is given containing the necessary particulars of certain streets. These have been scheduled to see how the streets stand in relation to the classes in the Specification.

When the initial decisions have been made and the lighting contracts placed with the lighting authority, the safeguards of the Specification are automatic. By its provisions, the installation when completed must be kept in such a condition that the minimum illumination required by the class is always provided. The installation can never be allowed to fall into neglect without breach of contract.

Mr. C. C. Paterson is an acknowledged authority on lighting; he is head of the C.E.C. research organisation

Perhaps the electricity supply is provided by one authority and maintenance by another. In such cases the responsibility for such factors as adequate supply voltage, lamp renewals and cleaning is shared, but the terms of the Specification still apply. When the committee or lighting engineer wishes to examine an installation for compliance with contract, the appropriate measurements of illumination are straightforward, and indicate at once whether or not the contract is being fulfilled.

Not a Perfect Specification

I remarked that the B.S. Specification is not perfect. That is because the principles of good street lighting are not yet fully understood and the art changes continuously. A Specification must not be too far ahead of current practice even when current practice admittedly falls short of the needs of the situation. We must, I think, admit that street lighting is exceptional amongst other engineering services in that the technical needs for yielding adequate visibility and safety can seldom be afforded with the funds available. We are constantly, therefore, seeking in street lighting to do the best we can with what can be afforded. So the Specification has had to include "classes" which would hardly have found a place in a specification for good street lighting, had not limitation of funds at the disposal of lighting authorities rendered them inevitable for the present.

Have we any expectation that this state of things will mend? Are developments possible which will give us really safe conditions at night in the complicated outskirts of our towns where cyclists, pedestrians, slow and fast moving traffic, rash and timorous drivers all conspire to make safety a relative term even by daylight? There are at least four definite directions along which substantial practical advance towards greater safety is possible. They aim at improving the seeing, by giving the driver a brighter road surface in front of him. They refrain from that all too frequent practice of increasing the glare at the same time as the road brightness, so leaving actual seeing power little improved.

In the first place, seeing could be greatly improved by using lighter coloured and more optically suitable road materials. For instance, by replacing the smooth tarred or asphalt road by a rougher road surface of lighter colour the brightness of the darker parts of the road and of the treacherous and unsuspected "black spots" can be increased severalfold. Some surveyors are paying careful attention to this means of increasing safety on the roads. It is one of the most promising, because an improvement of, say, three to one in the lightness of the road surface is much the same, from the motor driver's point of view, as putting up the power of the light three times.

Secondly, we can reduce glare. At present the chief obstacle in the path of glare reduction is the outlook of those on watch committees whose duty it is to choose installations. One is forced to the conclusion that they prefer glaring lights because they look bright, and do not consider the measure of "seeing power" afforded by the installation. Manufacturers are, therefore, forced to produce glaring fittings to meet this unfortunate demand. Until those responsible for deciding on the types of installation to be purchased have a fuller appreciation of the bad effect of glare on seeing, one does not expect much improvement in this direction.

Then in the third place experience is showing that many authorities are determined to increase the amount of light in their streets in spite of the call of economy, realising, I think, that effectively lighted streets are from many points of view an economy. There is no doubt of the general upward tendency of street illumination.

More Light at Less Cost

Fourthly, we have the advent of much more efficient sources of electric light in the form of gas discharge lamps. These offer the possibility of obtaining the light of a 1,000-W lamp installation with an expenditure of only 400 W per lamp. If it is recalled that a 1,000-W installation properly designed will really yield what may be called an "accident-proof" road at night, the new lamps bring conditions within the reach of most authorities which permit of safe driving by night at daylight speeds. Even with the latest electric gas discharge lamps, and ignoring further improvements in efficiency which may follow later, lighting authorities have for the first time the possibility of really first-class "accident-proof" street lighting with but small increase, if any, in electricity consumed.

THE CLASSIFICATION OF STREETS FOR LIGHTING

Name.	Arrangement.	Height ft.	Spacing ft.	Width ft.	Mean rated test-point illumination ft.-candles.	B.S. Specification classification and notes.
Queen's Rd....	Staggered	12	200	27' 6"	0.0026	None: Illumination too low, spacing height rather too great.
Kingstown Hill.	Central	21.5	229	41.5	0.068	F. Spacing height ratio greater than recommended.
London Rd.	Staggered	19.5	120	25	0.085	F.
King's Rd., north end.	Staggered	25	124	48	0.21	D.
King's Rd., south end.	Central	28	120	42	0.18	E.

Lighter road surfaces; the new discharge lamps; suppression of glare; and an inclination towards slightly greater expenditure in electricity by lighting authorities; what a vista is opened up of safety and of perfection in street lighting, a perfection which is within the reach of all!

Electricity a Cheap Servant

In the course of an informative address delivered at Barnham recently, Miss C. Haslett, director of the Electrical Association for Women, dealt with the economic use of electricity in the home. In her own flat in London, she said, her electricity bill was 10s. per week, including baths, cooking, heating, and many extras. A survey had shown that the working woman devoted sixty hours per week to her household tasks, whereas most men did not care to do more than forty-eight hours' work. The use of electricity would not develop as it should without trained women who could instruct. Lt.-Col. Waley Cohen presided, and Mr. R. V. Weare, manager of the Chichester Corporation Electricity Dept., arranged a demonstration of electrical appliances, the General Electric Co., Ltd., lending apparatus for the occasion.

The Maintenance of Domestic Apparatus. By H. G. F. Gamble

The necessity for adequate service

ALL supply undertakings must give serious consideration to properly organised maintenance and service departments; the inadequate and often half-hearted arrangements found in so many districts must be overhauled. The rapid developments and enormous public demand for electric domestic service during the last few years have occupied supply engineers with the more pressing problems of supply, distribution, public lighting, hire, sales development, &c. Now the question of service to the consumer must receive the same care, consideration and deliberation as the other sections of an undertaking.

In some undertakings it is anyone's job to repair the various pieces of apparatus brought in; they are sometimes left to the assistant engineer for attention when he has time, sometimes to the odd job man in the works (who is most probably not qualified or equipped), or even sent to the electrical contractor "down the street"; worse still, some undertakings will not repair apparatus at all unless it was purchased from them in the first instance. A supply undertaking should provide facilities to repair and maintain any and every piece of apparatus if requested by the consumer and the work should also be carried out without profit to the undertaking.

Mr. H. G. F. Gamble is area sales engineer (Central Area) for the North Metropolitan Electric Power Supply Co.

It should be obvious that apparatus off the mains through some defect can no longer contribute to the earning power of the undertaking and, far worse, the consumer has no longer the use of apparatus that had become an important factor in the household arrangements. A disappointed consumer is the result, and this is probably the worst aspect of the case because one cannot estimate the damage thereby done to the industry as a whole. Some undertakings have equipped workshops and provide staffs for the maintenance and repair of hired apparatus only, such as cookers, wash-boilers, and kettles, but will not repair irons, toasters, fires, water heaters and vacuum cleaners. Surely this is a one-sided and short-sighted policy.

Service Pays for Itself

The equipment and staff necessary to run an efficient service department need not be expensive, and though not making a profit may easily be made to pay for itself. Even if it becomes a charge on the undertaking it is justified, because completely satisfied consumers are its "life blood"; increased sales of energy will depend upon the consumer using more and more apparatus. Therefore I urge supply engineers to put their "house in order" immediately. Sales of all classes of apparatus are increasing and the problem is urgent; a small well-organised beginning will make a sound foundation for the future. One should not count the cost now; it may be too late later on!

I have found in practice that the ideal arrangement is to run the maintenance department (that is, the department organised for the repair of minor faults on consumers' installations) together with the repair department, housed in the same building or workshop, and under the control of the same sales or assistant engineer. Carefully selected maintenance wiremen or electricians who are engaged in removing faults, replacing fuses and making minor repairs to installations, if properly instructed and trained, can bring in sufficient apparatus to the shops to keep the repair department busy. It is understood, however, that wherever possible simple repairs to apparatus should be carried out on the consumer's premises, providing they can be done expeditiously without disturbance to the consumer and without damage to any of the household effects.

If the work can be dealt with more efficiently at the repair shop, the apparatus should be repaired and returned the same day; if this is not possible, or if a spare part has to be obtained from the manufacturer, the consumer should be notified immediately, either by post card or a standard letter, with an offer of the loan of a similar piece of apparatus until the return of his own property. Manufacturers, unfortunately, do not give sufficient attention to small orders for replacing parts; vexatious delays occur which the consumer finds difficult to understand, and he usually blames the supply undertaking. The cost of supplying, solely for loan purposes, an assortment of irons, kettles, toasters, vacuum cleaners, hair dryers, etc., should not be taken into account; it is service to the consumer that is the main thing. A sum of, say, £100 will provide sufficient pieces of apparatus to give a good deal of service. It must not be forgotten that apparatus on loan will earn money whilst the consumer's apparatus is under repair, and so the capital outlay will be recovered indirectly.

Simple Arrangements are Sufficient

The equipment of the repair shop is not at all a serious matter. Nearly every class of repair for an undertaking with up to 10,000 consumers can be undertaken in a shop measuring 20 ft. square, equipped with a small lathe, drilling machine, portable drill, polishing head and a good bench, and in communication with the showroom or office direct by telephone. Bins for spares of every description and racks to keep apparatus off the floor complete this simple equipment, and an intelligent and fully qualified electrical fitter and mate supervised by an assistant brought up on "service" will do more to establish the electrical idea and era than can be estimated. The fitter must know his job; the semi-skilled man will not do, neither will the old servant from some other department fill the bill; the repair leaving the shop must be a good one and carry the guarantee of the undertaking.

In a larger concern supplying a scattered area, a motor-cycle carrier is necessary, because the aim of the department should be to repair, complete and return the apparatus the same day; the transport can be used to deliver other showroom sales and small pieces of hired apparatus. Wherever possible the repairs should be carried out without charge, but if this is not possible the net cost of the repair or replacement plus 10 per cent. as overhead charge should be sufficient; the department should not be expected to make a profit.

Finally, I urge manufacturers to appreciate our difficulties and give better co-operation and service. They can learn a good deal from the motor-car industry, where "service after sales" to the dealer receives the first consideration and, indeed, is given as part of the sale. Our competitors realised the importance of the subject many years ago, and to-day give a reliable and immediate service to their consumers which, in the aggregate, costs many thousands a year. Can we afford to lag behind?

Paints for Electrical Equipment

IN introducing a series of paints specially prepared for treating electrical equipment, Messrs. Donald Macpherson & Co., Ltd., Knott Mill, Deansgate, Manchester, promise to meet some pressing needs of the industry, even to the extent of offering a probable solution of the "returned cooker problem."

Recently developed "Foochow" paints for cookers, fires, etc., are claimed to be a very near approach, when properly applied, to vitreous enamelling, so that the older type "black" cookers may be inexpensively finished in almost any colour, including mottled effects, which will stand heat and resist acids, oils, etc.

Equipment can be treated very quickly, and where two coats are necessary, the second coat can be applied before the first one is dry. For complete success, spraying and hot stoving are necessary, but the actual costs of the necessary equipment could hardly be a serious item to any supply undertaking with a reasonable quantity of "old" cookers to renovate.

The company's long experience in producing paints for structural steel work has stood it in good stead for providing finishing materials for heavier electrical equipment. For instance, a three-coat process has been developed for transformers. A priming coat is sprayed or dipped by the tank maker, an intermediate coat is applied by the electrical assembler, and the final coat is put on on site. The three coats are scientifically built to key with one another, and the first two coats are made from basic pigments and designed so as not to affect the final coat. The whole is rust and transformer-oil resisting. Since the company turned its attention recently to maintenance paints much more elastic skins have been developed.

The makers claim that "Synroz" paints for switchboards, meters, etc., will stand rough handling, and are alkali, weak-acid, salt-water and grease resisting. They are of the synthetic-resin family, extraordinary elastic, and yet are quicker drying than ordinary enamels.

Service to the Consumer.

By W. F. T. Pinkney, M.I.E.E.

A VERY great change has been made in the method of marketing electricity supply in the last six or seven years, and the purchaser of a given measure of electrical energy buys a good deal more than metered units. We are now selling a service—not merely a given quantity of energy.

The days have gone when we received prospective consumers at a discouraging little square window, cut in a glass partition, which, in itself, prevented any feeling of friendly reception, and we now meet those who would buy from us in a manner that is more likely to inspire confidence, and under conditions which will give the buyer elbow-room when he signs his form of application for supply. The modern reception office has an appearance of welcome: here the staff should be able to give all information likely to be asked for, and here application forms, ink, pens (with useable nibs) and *clean* blotting-paper are all to hand.

While we have broadened our outlook upon the commercial side of electricity supply, we have also widened the field of distribution, as those who live in small towns and villages are now better able to secure the benefits of electricity supply which are amongst the recognised amenities of modern life. What should the consumer expect in the way of service—whether he lives in a city, a market town, or a village?

He should certainly have the energy available to him at terms which will enable—and indeed encourage—him to make extensive use of it. Although he may not, at the present time, in all cases be able to obtain his supply at terms as favourable in the rural areas as he can in the large towns, the tendency should be—and doubtless will be—to level the rates of charging so that in the course of the next few years when development of the business in the less populous areas has increased, the present large differences in charges in different areas will be reduced. Those who live in cities or in villages should equally expect facilities to be afforded to them in the way of assisted wiring, easy purchase (a much more acceptable term than "hire-purchase"), hire of appliances, &c. As such schemes are self-supporting, it should be possible to make them available to everyone, and they are really outside of the service which should be included in the supply of energy.

The Employés' Part

The first contact which the prospective consumer makes with his supply authority is usually through the canvasser, the salesman or the consumers' engineer, and care should be exercised that the impression is given of genuine personal interest in the requirements and well-being of the consumer, so that again he may acquire confidence in those who are advising him upon his electrical requirements. It is equally important that the house service men, when laying in the service cable, should exercise care to disturb as little as possible the consumer's front garden, and should consult him—where possible—as to the run of the cable. Neglect of these courtesies is apt to cause considerable and lasting irritation.

The travelling showroom of the "Nesco" group

Advertising is important to consumers as it not only interests them but enables them to keep up to date, and consumers are entitled to have brought to their notice the many comforts and benefits which electricity can confer. It is by advertising, too, that additional business is secured, and additional business—more than anything else—will bring nearer the day when electricity will be supplied even more cheaply. If an electricity undertaking does not advertise sufficiently and efficiently, the consumers have justifiable grounds for complaint that the electric service is not what it should be.

Akin to advertising is the showroom service which should enable the consumer to see, and have demonstrated to him, all the appliances which will benefit him in his office, his home, and in his business. He must have confidence that whatever he sees or purchases in a showroom is the most reliable which he can obtain at the price he pays. There is still much room for improvement in the showroom service. There are many fine showrooms with efficient organisations and staffs in the larger cities, but it is not all undertakings that can afford large showrooms with a large staff. Nevertheless any electricity undertaking can have a showroom, however small, and as the first impression of electric service is often obtained in such a showroom, it should be—outside and inside—indicative of the cleanliness and efficiency of electricity. There should be no soiled crepe paper or dead flies in the window, no dust upon the appliances displayed. The attendants should be neatly dressed and competently trained in retail selling, and fully cognisant of the service that the undertaking is able to offer. There is no excuse for the unattractive and dreary-looking window displays, still somewhat common in showrooms, as the adoption of the excellent E.D.A. showroom window service ensures against this.

Mr. W. F. T. Pinkney is engineer in the Lighting and Heating Department of the North-Eastern Electric Supply Co., Ltd.

In the rural areas a travelling showroom seems to be the only practicable means of bringing to the consumer's knowledge the benefits which electricity can confer upon him, and the type of travelling showroom which the N.E.S. Co. first introduced to the industry, with a useable floor-space twenty-one feet square, can not only display a fairly large number of appliances, but can be used for lectures and demonstrations to a seated audience up to fifty.

Faults and repair service is another matter in which the consumer is entitled to efficiency, and although fuses may not blow, or faults occur with great frequency, yet when a main fuse does blow, rapid renewal is of great importance to the user. Every consumer will, as a matter of course, be supplied with suitable fuse wire for his own fuse replacements. In the large towns "fire-station" service should be provided so that attention to faults, day or night, can be given within a few minutes. Even in rural areas a call should have attention within an hour.

Quick and Cheap Repairs

Appliance repairs are often a nuisance to the consumer, and it is a good plan to have a "quick repair service" in the showroom by which appliances, in many cases, can be repaired and adjusted, or the flex renewed, while the consumer waits. If material only is charged for it creates a good impression. Apart from the convenience to the user of facilities for repairing appliances, there is the common-sense aspect to the undertaking that if there is no repair service available, the appliances may remain out of use and cease to earn revenue.

Special consumers are entitled to consideration—that is—those in special trades or professions, and they should have brought to their notice the latest applications and the latest appliances to meet their particular needs. These are met by short-period exhibitions which can be arranged in a showroom, and usually with the co-operation of the manufacturers. All dentists, office organisers, small factory managers,

or whatever is the class of consumer to which the particular exhibit is of special interest, can be invited. Even the simple bell transformer—which earns no revenue for the undertaking, but is such a boon to the domestic user—ought, in all fairness to the consumer, to be brought to his notice.

A new problem has cropped up in the last few years, and that is the supply to the weekly wage-earning householder. He presents some difficulty because he has always been used to buying in "pennyworths" and must have a prepayment meter. As he usually pays a higher price per unit than the credit consumer, it is a wise provision, and in his interest, to include sufficient in the rate charged to allow of free lamps being supplied to him. This type of consumer has difficulty in finding the price of a lamp just when it is required. At the same time, he is entitled to the same sort of service as the consumer in the larger house, but it is rather more difficult to bring to his notice the benefits securable from the use of electrical appliances, and to offer such appliances on attractive terms. My experience shows, however, that it can be done, as a small campaign carried out last year on a simple easy purchase scheme secured over four thousand appliance sales to prepayment consumers in one month.

Some simple instruction in the use of the electric service should be given every consumer, and if he does not get it, he should demand it from his local supply authority. Information upon the use of appliances; upon how to read the meter; how to renew fuses; the tariffs available to him, &c., should be available. This necessitates a service booklet, and any undertaking which has not already published one, will shortly have at its disposal one published by the E.D.A.

It is true that service is akin to salesmanship, and if the consumer gets the service to which he is entitled—and when he realises it, he will come to demand it—the sales will follow as a matter of course. Service, in the true sense, helps to build and maintain goodwill, and goodwill is a most important and valuable asset to any trading enterprise.

Dealing with Faults.

By L. A. Gripper, A.M.I.E.E.

IN this article I do not propose to detail the various methods of carrying out fault location tests, but rather to lay stress on the organisation necessary to deal effectively and efficiently with failure of supply in connection with low-voltage distribution networks. Local conditions vary so much that it is impossible to lay down hard and fast rules; on the other hand, there are certain common factors which definitely lead to efficiency.

Even in these days of reliable apparatus many mains engineers still go about their work in dread of a shut-down. If this is due to anticipation of overload troubles, then it is a matter of policy affecting the layout and expansion of their network. Difficult conditions, poor workmanship, or poor apparatus will all tend to this feeling in varying degrees. If it is merely due to the possibility of a fault, a considerable amount of worry can be eliminated by taking steps to ensure that faults will be efficiently dealt with.

The first thing to check is the "line of communication." During office hours notification of a fault is usually received direct by the mains department from some consumer who is affected. It is essential that the organisation should be such that a responsible engineer can be communicated with in some way or another within a reasonable time. For dealing with faults that occur out of office hours it is important that some definite arrangements should hold regarding the communication of messages and the obtaining of assistance. Further, transport must be considered. In large undertakings vehicles are often cleaned in the evenings and drivers are available in case of emergency. In smaller undertakings it is not always quite so easy to arrange things as one would like, but usually some suitable scheme can be planned.

Essentials of a Network Diagram

One of the most vital factors in dealing with network faults is the network diagram. The layout of the plan is important, as it is not always practicable to keep accurately to scale owing to the congestion often found around sub-stations. It is essential not to sacrifice clearness for scale. As a rough guide the built-in areas of a town can be laid out to about 45 yards to the inch and this can gradually be changed as the outskirts are approached to about 100 yards to the inch in regard to distance between feeding points. In any case, allowance must be made for future extensions to the network.

Sizes of distributors, positions of link boxes, pillars, sub-stations, and names of streets should be clearly indicated and, if thought desirable, the feeding points for hospitals and important public places. The links at breaking points should be shown in pencil so that alterations can be made when necessary. This diagram should be mounted in the mains office and put under the charge of one man to whom notice must be given when alterations to the network are made.

The question of whether the diagram should be one large sheet or divided up is a local one. Very often it is advisable to have a separate plan for the centre of a town or special congested areas. In any case it is important that this diagram shall be available to engineers, and, furthermore, that full use is made of it when considering extensions, voltage complaints, and loads on distributors, as in this way the staff will all have a common view of the network.

There are two points which some mains engineers will bring forward after reading these suggestions. The first is the question of the cost of preparation; the answer to that is that the development and extension of a network can be carried out more economically if the layout is carefully studied in the first place, and a network diagram offers proper facilities for this. The second point is the question of keeping diagrams up to date. Provided that they are kept solely as low-voltage network diagrams, indicating distributors and feeding points, and are not complicated by extraneous details, no difficulty should be experienced in keeping them up to date, so long as they are in the hands of a capable man.

Copies for Maintenance Men

In the case of faults the use of such a diagram is invaluable. Copies can be mounted in sectional book form and kept in suitable flat metal cases, about three feet by two feet, together with schedules giving addresses and telephone numbers of staff employés, details of special keys to sub-stations when special knowledge is required to gain an entry, sub-stations where extra tools are kept, and any other useful particulars which local conditions call for. In the day-time, help can usually be obtained en route for the fault. At night a suitable emergency kit together with plans can be kept available. It is important that any such plans should be brought in regularly for checking and correction.

The great advantage of portable network diagrams lies in the fact that the fault engineer can proceed to the area affected, feeling himself free to concentrate on the actual fault, inasmuch as he knows that he has with him complete details of the system, laid out on lines with which he is well acquainted, rather than having to try to memorise work which perhaps he carried out years previously.

It is, of course, impossible to lay down any detailed method of dealing with faults, as local conditions and systems of supply vary so. Generally speaking, if two or more consumers complain of a failure of supply the first port of call is the sub-station which feeds the particular area concerned. Once satisfied that the high-voltage supply is not affected, attention can be turned to outgoing distributors. Unless it is certain that overload is the cause of a blown distributor fuse it is usually unwise to replace it with a heavy fuse in the first place. A simple test fuse made up in portable box form, and arranged as a bridge-type fuse in series with a switch and equipped with insulated leads of sufficient length to reach to fuse or link box contacts, is very convenient for preliminary testing purposes.

Mr. L. A. Gripper is deputy borough electrical engineer at Eastbourne

Assuming, however, that all is well in the sub-station the next move is probably to call on some of the consumers who have complained. In this way an indication of the extent of the fault can be obtained with a view to sectionalising the network, so as to obtain a partial restoration of supply. It is extremely important to carry a proper stock of spare fuses in sub-stations.

The principle of having special sets of useful tools strategically placed in important sub-stations is well worth consideration. Such tools as picks, shovels, link-box keys, hurricane lamps, and sundry other useful tools often save a journey to the main depôt. Once the mains engineer has taken steps to ensure that he and his staff are properly equipped, and that facilities are given to all concerned for studying new apparatus prior to its being put into commission, he has made a useful contribution towards the rapid restoration of the supply in case of a failure.

The Tramways and Light Railways Congress

Proceedings at Leeds

THE twenty-third annual congress of the Tramways, Light Railways and Transport Association, which was held at Leeds from June 7th to 9th, served to demonstrate the great vitality of the road passenger transport industry at the present time.

The rapid developments that are taking place in regard to the modernisation of tramway systems, petrol and oil buses and trolley-buses—and both municipal and company undertakings are now dealing with all these forms of traction and are no longer tramway undertakings as they were in the beginning—are responsible for the large number of manufacturers' representatives who attend these conferences.

There was the usual informal reception by the chairman of Council—Mr. E. H. Edwardes—at the Queen's Hotel on Wednesday evening, June 8th; the Congress proper opened in the Queen's Hotel on the following morning when the Deputy Mayor of Leeds—Alderman Eric Clarke—extended a civic welcome to the Association. The annual meeting of the Association followed. The Council has elected Col. S. E. Smith, C.B.E. (director and manager of the Bristol Tramways and Carriage Co.) to succeed Mr. E. H. Edwardes (managing director, South Lancashire Transport Co.) as chairman of Council, who presided throughout the meetings.

Mr. Edwardes reviewed the work of the Council during the past year, which has been largely occupied with matters arising out of the rules and regulations of the Ministry of Transport under the Road Traffic Act and the possibilities created under the new Salter report scheme, in addition, of course, to the position under the London Passenger Transport Act. Satisfaction was expressed that the trolley-bus had had no further taxation or restrictions placed upon it by the Chancellor of the Exchequer in his recent Budget.

The following new members of Council were elected: Messrs. J. Leigh Burton (English Electric Co., Ltd.); Frank Buckley (general manager, Norwich Electric Tramways Co.); W. Vincent Edwards (general manager, Hastings Electric Tramways Co.); C. A. Hopkins (general manager, Sunderland Corporation Tramways); G. H. Margrave (general manager, Yorkshire (W.R.) Tramways Co.); and W. Vane Morland (general manager, Leeds City Tramways).

Modern Passenger Transportation

At the conclusion of the annual general meeting a paper on "Modern Mass Transportation Methods," by Mr. W. Vane Morland, was read and discussed. In the course of this Mr. Vane Morland dealt with the new 70-seater tramcar with regenerative braking which the Leeds City Tramways have recently put into service. (See our last issue, page 804.)

In opening the discussion Mr. R. S. Pilcher (general manager, Manchester Corporation Transport), who advocated the conversion of tramway routes to buses wherever possible even in crowded cities, asked what the position in London was likely to be under the new Passenger Transport Board. He alleged that many tramways would be removed where bus services operated. Mr. Morland had predicted a new era for tramways, but the speaker disagreed with this, and urged any manager who had not converted a tramway or buses on busy routes to do so. No fewer than fourteen members of the Association had abandoned tramways, all trams had been taken off the streets of Paris, and in all Italian cities instructions had been issued demanding the cessation of tramway services. He also saw in the adoption of the trolley-bus in London a beginning of the same process.

Mr. Morland said that neither he nor the Leeds Committee intended to perpetuate tramways in their present form. The new Leeds regenerative control car had been built for a specific purpose, *viz.*, to run over a sleepered light railway track. Surely Mr. Pilcher did not really believe that buses could handle the flood of traffic in London.

Mr. C. Hopkins (general manager, Sunderland Corporation Tramways and Motors) suggested that Mr. Morland should have abandoned the old-fashioned trolley arm on his new tramcar and adopted the bow collector. Commenting on the controversy of buses *versus* tramways, he claimed that a great deal could be done by modernising tramcars instead of expecting tramcars many years old to compete with modern buses. Mr. F. A. Fitzpayne (transport manager, Edinburgh) said that the result of experiments carried out in Edinburgh were in favour of regenerative control. The weight of the new Leeds car was 496 lb. per seat; a lighter car had been evolved in Edinburgh, using aluminium alloy, giving 421 lb. per seat. Another car built for Edinburgh by the Metropolitan-Cammell-Weymann organisation had a weight of only 417 lb. per seat.

Mr. R. McCreary (general manager, Belfast City Tramways and Motors Dept.) urged the need for sanction to a greater number of standing passengers in trolley-buses. Mr. G. H. Margrave (general manager, Yorkshire (West Riding) Electric Tramways Co.) also urged the need for modification of the existing overloading regulations, and agreed with Mr. Pilcher that the omnibus was the better vehicle for road passenger transport.

Mr. Vane Morland, replying to the discussion, said that the use of the bow collector had been considered, but there were difficulties because the Middleton line had been constructed on the side-running principle, but it was intended to make the change eventually. It was proposed to equip the Middleton route entirely with the regenerative type of rolling stock if the new car came up to expectations. It had been decided that a too-light type of car was not desirable for light railway operation.

Those who some years ago had advocated some form of traffic control never dreamed that such a mass of legislation and such a mass of restrictions would be inflicted on the industry, and he considered that if one or two men trained in the industry tackled the problem, the procedure of the Traffic Commissioners and their staffs could be very considerably simplified.

The Annual Dinner

The president of the Association, Sir Arthur Stanley, presided over a company of more than 300 members, ladies and guests at the annual dinner, which was held in the Queen's Hotel on June 8th.

Responding to the toast of "Our Guests," proposed by the President, the Lord Mayor of Leeds (Alderman R. H. Blackburn, J.P.) said that Leeds would be very poor indeed but for the profits which were allocated from the tramway undertaking to the relief of rates, and he recommended other municipal transport undertakings to adopt the policy carried out in Leeds, *viz.*, to carry the people at the lowest possible fares and induce so much traffic that large profits could be made. Mr. L. C. F. Bellamy (general manager, Hong Kong Tramways Co.), who also replied, said that all buses had been abandoned in Hong Kong owing to the peculiar conditions of a small but very densely populated area which called for a one-minute tram service.

Mr. A. R. Fearnley (general manager, Sheffield Corporation Transport Dept.), who made the final response in the absence of Mr. C. Furness, President of the Municipal Tramways and Transport Association, spoke of the co-operation now taking place between the two tramway and transport associations. Referring to developments in London passenger transport, he said that a similar movement in the direction of amalgamation, although on a smaller scale, was taking place in Lancashire, which suggested that the time was coming when small transport units could no longer exist.

Responding to the toast of "The Tramways and Light Railways Association," proposed by Alderman F. Leach (chairman of the Leeds Tramways Committee), Mr. E. H. Edwardes expressed his regret that there should be three Associations dealing with road passenger transport, *viz.*, the two tramway associations and the Omnibus Association, and suggested there was a need for one united organisation to represent all interests. The remaining toast was "Our President," which was proposed by Sir John Timpson and was briefly acknowledged by Sir Arthur Stanley, who said that the whole success of the Association depended upon the valuable work done by its secretary, Mr. De Turckheim.

Regeneration on Trolley Vehicles

Two papers were read and discussed on the following morning, Friday, June 9th, *viz.*, "Regeneration on Trolley Vehicles," by Mr. W. A. Stevens, and "Various Types of Fuel used in Omnibus Engines." The latter referred solely to motor-bus working. Mr. Stevens's paper surveyed the question of regeneration in a very able and thorough manner. It aroused an interesting discussion which was opened by Mr. G. H. Fletcher (Metropolitan-Vickers Electrical Co., Ltd.), who suggested that many designers would disagree with the author in adopting a shunt characteristic for regeneration. Such a characteristic lacked the stability obtained with a small number of series turns in circuit which give a rising characteristic during regeneration, preventing a rush of current due to sudden variations in voltage. There were other difficulties

The speaker expressed a preference for Class B insulation, because it was practically indestructible at any temperature likely to be reached in service. Some sacrifice should be made as regarded current consumption to secure a more robust

motor costing less in maintenance and having greater reliabiliy.

Mr. H. L. Brodie (Sunbeam Motor Co.) disagreed with the author's preference for putting the motor in the front of the vehicle, and pointed out that considerable experience in manufacturers' chassis with the motor in the centre of the vehicle had shown many advantages. Mr. W. V. Edwards (general manager and engineer, Hastings and District Electric Tramways Co., Ltd.) said that very satisfactory service had been given for some years in Hastings with vehicles equipped on Mr. Stevens's regenerative control system. There had not been a single failure of a shunt field coil or of the armature winding insulation.

Mr. A. W. A. Chivers (British Electrical Federation, Ltd.) said that while the motor used by Raworth had all the characteristics of the shunt wound motor it really was a separately excited motor. The electrical tension on a regenerative motor was more severe than in the case of an ordinary series or compound wound motor, and he urged that this point should not be minimised by advocates of the regenerative system.

The chairman considered that if trolley-buses were to live they would only do so if maintenance costs were cut down to the minimum. His own advocacy of regenerative operation was due to the fact that it reduced maintenance. Rheostatic braking in the past had not been made proper use of, in his opinion.

Mr. Stevens, in his reply to the discussion, thought he could meet Mr. Fletcher half way on the question of the shunt characteristic by introducing, say, half a dozen series turns to help the regenerative braking. He expressed a preference for Class A insulation and enamelled copper wire because of the larger space factor. He still maintained that the front was the better place for the motor because of the larger space available to fit in the larger motor required with regenerative control.

The members attending the Congress were entertained at luncheon at the Grand Hotel, Harrogate, by the four Yorkshire transport companies, and in the evening there was a reception, dance and cabaret at the Leeds Town Hall on the invitation of the Leeds City Tramways Committee.

Correspondence

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession

The Mounting of Water Heaters

In view of the extremely attractive tariffs now being offered for off-peak storage water heaters, these are being installed in many houses. Most makers provide 10- and 15-gallon sizes with wall fixing brackets so that the heater hangs without any support from underneath. As I have experienced trouble with this method, especially in new houses with 4½-in. brick walls, I should be interested to hear the views of other readers on this subject.

The insertion of bolts through the wall disturbs plaster and paper in the next room, while large plug holes crack up the wall and are liable to displace bricks. Various patent plugs loosen owing to disintegration of the wall and warping of battens, while there is always danger due to screws rusting through. The only alternative seems to be some type of floor mounting which, like a really substantial wall fixing, does not appeal to the æsthetic taste of the average householder. Perhaps, however, other readers have ingenious solutions to all these troubles. B. AND B.

June 10th.

Mechanical Soundness in Electrical Appliances

Electricity is applied to so many devices to-day that its power and benefit is well known. There is, however, another side to this question, that of the mechanical soundness of electrical devices. If this is lost sight of, or not understood, the purchaser of an article electrically driven, but unsound mechanically, may thereafter have a real prejudice against all electrical appliances.

There are only two ways by which this danger to legitimate trade can be combated. The first of these, that of bestowing on a majority of the public, an elementary, but accurate, knowledge of what constitutes fundamental mechanical soundness, may be dismissed as an immediately practical proposition, but it may come in a generation or two, as the result of teaching in the schools. The second way is by means of a higher and better method of advertising individual products, and by advertising is not meant alone the written word, but the teaching given orally by those responsible for distribution work.

Whatever the unscrupulous may seem momentarily to gain by selling an unsound product it is certain that such illicit trading does incalculable harm. Aggrieved customers of electrical goods will hesitate before again becoming purchasers, thus slowing down the rapid circulation of money, so necessary for the prosperity of all. Better and more speedy educational work is needed for the protection of the honest trader.

East Croydon, *June 10th.* LESLIE F. DAVIES.

Low-voltage Synchronous Clocks

We were pleased to notice in your issue of June 2nd a letter from "Interested" in which, after pointing out the many advantages possessed by the synchronous clock, he suggests that on grounds of safety these clocks might to advantage be wound for a much lower voltage than that of the supply. From the manufacturing point of view, there is no difficulty whatever in arranging for any desired voltage and for certain purposes this possesses distinct advantages. We have, in fact, supplied a number of clocks wound for pressures in the neighbourhood of 20 V, operated from the low voltage side of miniature step-down transformers.

Besides the advantages enumerated by "Interested," cases sometimes arise in which for safety reasons it is customary to cut off the electricity supply, each night, from a whole section of a building. This practice is not uncommon in some schools, for example, and in such a case, a low-voltage circuit (at, say, 20 V) may be left alive for the operation of the synchronous clocks. As regards the choice of voltage, this is largely a question of the number of clocks installed. Up to twenty or thirty clocks 20 V is quite satisfactory, but for a larger number 50 V has much to recommend it, and from the point of view of safety there is little to choose. For a single clock a voltage of 6 or 12, as suggested by "Interested," could certainly be used, but it seems doubtful whether so low a voltage represents any great advantage over a somewhat higher one.

For the ordinary domestic clock, whilst a length of "live" flexible is doubtless theoretically unsound, actually, it appears to work well and one of the recently introduced fuse sockets or plugs affords all the protection that is required. We have not heard of a single case of fire or accident in connection with a clock in spite of the very large number which are in constant use. SYNCLOCKS, LTD.

Hendon, N.W.9, *June 10th.*

Cross-talk in a Colliery

A multiway double-wire-armoured v.i.r. telephone cable was recently installed in a colliery shaft and connected to 'phones top and bottom. For reasons unknown, conversation carried on in one line is distinctly repeated in any of the others. This cross-talk is not the result of electro-magnetic induction, for there is no noise produced whatsoever. Only the centre pair of wires is twisted together, all others are laid round the centre pair in parallel with each other.

Condensers, earthing of the armour or the 'phones themselves make no difference. The total length of cable is about 1,900 ft. If any of your readers have had a similar experience and know of a remedy, I should be delighted if they would let me know through your valued paper. PERPLEXED.

June 8th.

The Reorganisation of E.D.A.

It is welcome news, even if a little belated, to note from your current issue that the Central Electricity Board, in co-operation with a reorganised E.D.A., is now making serious efforts to develop and extend electricity consumption. This will act as a tonic to all in the electrical industry.

The controlling council of the new organisation appears to be excessive in number, and restricted to the electricity supply and distribution interests. Manufacturers and the trade who have supported E.D.A. in the past should be represented on the Council, otherwise their interests will be subordinated to the electricity supply interests. To be effective the new scheme should secure the hearty co-operation of all sections of the electrical industry, and not be confined to any one section.

The present industrial depression indicates that the greatest success in extending electricity consumption is dependent on the more intensive development of the domestic load in contradistinction to industrial load. The domestic load can only be secured by offering service, terms and equipment competitive with other interests. Charges for domestic electricity supply

are in many instances excessive, and the variation in charges does not help in creating public good will. The cost of wiring and the installation of apparatus deters many prospective consumers from taking advantage of the benefits of electricity supply.

Capital has been provided for generation and distribution, why cannot further capital be provided for wiring and the installation of apparatus on hire, hire purchase or rental terms? This would limit the immediate outlay to the prospective consumer, and increase very considerably the number of new consumers who would be prepared to take advantage of electric service.

Dwelling houses in thousands have been built and purchased on mortgage, and there do not appear to be any serious objections to the all-electric home being made a success on similar lines, particularly in view of the present low cost for money. The electrical industry has a glorious opportunity of prosperous development on these lines by offering the public a service they can afford, for the desire for electricity supply is universal.

The complete electric kitchen could be developed in this country with advantage to all electrical interests. We must sell our products in bulk and not piecemeal as at present. The development of domestic electrification is more a commercial than a technical problem—hence my advocacy of commercial interests on the new council.

The general public should be protected against inferior, unreliable, and defective electrical products and apparatus, and the new council should take steps to set up a National Testing Laboratory to which manufacturers could submit their products for test and approval. This would eliminate a good deal of the rubbish that is now sold to the public. It appears ridiculous to insist on high standards of wiring and then allow any shoddy type of apparatus to be installed. The general public are not particularly interested in the qualities of any system of wiring, but are vitally interested in the performance, service, and reliability of the consuming apparatus.

A National Electrical Exhibition under the auspices of the reorganised E.D.A. would be helpful in securing the co-operation of all interests and would give the public, whom we are anxious to cultivate, the opportunity of investigating under operating conditions the manifold services electricity can offer to them.

Modern conditions demand that the electrical industry shall adopt a more aggressive development and selling policy than has hitherto been the case if we are to obtain the results we all so earnestly desire and to justify the capital expended on the national grid scheme. Sectional interests must not dominate the position. A common policy embracing all interests is the one that offers the greatest scope for ultimate success.

ARTHUR IMBERY.

Halifax, *June 12th.*

Electric Light Flicker

Mr. Skowron's article on this subject in your issue of June 2nd brings forward a very important point in the design of small engine-driven d.c. generators. It again emphasises the fact that the cyclic irregularity allowed by the British Standards Institution is in many cases too great to ensure the absence of visible flicker.

On comparing Mr. Skowron's curve with the results of the investigations of the Research Association, published in the *Journal* of the I.E.E. (Vol. 64, p. 1089), it will be seen that the former allows considerably more irregularity than the latter, taking into consideration the gasfilled lamp only. Since the Research Association arrived at its results by an exhaustive series of tests, it will be of interest to know by what means Mr. Skowron's curve was obtained.

ROBT. G. JAKEMAN.

Birmingham, *June 12th.*

What is a Consultant?

The query in the heading of the letter by Mr. A. H. Dykes, which appears in the ELECTRICAL REVIEW of June 9th, is the most significant one that has been printed with regard to the electrical profession for a long time past. The text of the letter is of vital importance, but statements of a similar nature have been made from time to time without, so far as I can see, any result.

Not having the honour of being a consulting engineer, I naturally do not know all the rules or etiquette of the profession, but I think it is entirely wrong that some of the best brains in the Association should not be fully available for the highly technical electrical work which has to be done to-day. Is it not possible, without contravening the rules, for the Association to issue to contractors, architects, and public officials a list of the consulting engineers in their respective districts? This could not be considered individual advertising, and such an action might help very greatly to place consulting engineers in their proper sphere.

SALESMAN.

June 12th.

I am sure that every consulting engineer maintaining his own office and staff will agree with Mr. A. H. Dykes that immediate action is necessary on the part of the governing bodies in the engineering world. Cannot the Institution of Electrical Engineers safeguard its members who are acting as consultants in strict accordance with the rules for professional conduct?

A letter from me on this question appeared in the *Builder* of June 2nd, but, unless the I.E.E. can influence the R.I.B.A. to appeal to its members, I doubt whether any beneficial result will be obtained for the very reasons stated in Mr. Dykes's letter. Mr. Dykes evokes the aid of the technical Press against the misuse of the term "consulting engineer," but how are the editors of the lay papers, including the cinema Press, to discriminate? They have to rely on particulars they receive for publication.

If the manufacturers persist in not giving a "square deal," then a partial remedy appears in "showing the door" to the representatives of those particular manufacturers when they call to solicit tenders.

J. C. ELVY.

London, W.1, *June 12th.*

The Royal Bath Hotel, Bournemouth, floodlighted for the I.M.E.A. Convention. **(See note on page 879)**

Long Overhead-line Spans

It is interesting to note in June 2nd issue of the ELECTRICAL REVIEW, under the heading "Development at Dorking," a reference to an overhead-line span 915 ft. in length, and a statement that the span is believed to be the longest for the size of conductor used in Great Britain. This is not so, as in my area, on the Wilsden and Cullingworth line, I have a span of 2,000 ft. steel-cored aluminium of the same capacity, which, you will observe, is over twice the length of the one mentioned.

O. G. COOK, *Chief Engineer and Manager,*

Bingley, *June 7th.* U.D.C. Electricity Department.

Our Personal Column

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements

Mr. A. Hugh Seabrook, M.I.E.E., M.I.Mech.E., the author of the article on "Free Advertising for Electricity" appearing on another page of this issue, has had a very wide experience of practically every kind arising in the field of electricity supply. He began his electrical career as a Crompton man at Chelmsford, and after periods at the Great Yarmouth and Hampstead electricity works he entered upon a series of appointments as engineer and manager of three undertakings, first at Barking, next at West Ham, and then as every electricity supply man well knows at St. Marylebone, where he occupied an outstanding position with remarkable success. While at West Ham and St. Marylebone he showed his pioneering spirit in propaganda matters, in the development of domestic electric heating and cooking, and in the charging of very low rates. At St. Marylebone one halfpenny per unit was charged for domestic purposes, combined, of course, with a two-part tariff, while hire and maintenance of apparatus, canvassing and showrooms, cooking demonstrations and local publicity were features of his operations, the financial results of which amply justified such enterprise. Some of our manufacturers of heating apparatus will remember the value derived by them from experience obtained between 1909 and 1918 at St. Marylebone. Since leaving St. Marylebone Mr. Seabrook has acted as consulting engineer and adviser in connection with the purchase of some electricity undertakings and the installation of many others, while his services as an expert witness have been utilised both before Parliamentary Committees and in the Law Courts.

Mr. W. C. Gomersall, managing director of China Engineers, Ltd., is on leave in this country, and his address is c/o Nathan & Allen, Ltd., 131, Victoria Street, London, S.W.1.

Mr. C. W. Wheal, of the Sturtevant Engineering Co., Ltd., is now in residence at 54, Doveridge Road, Hall Green, Birmingham (telephone, Shirley 1046). This will enable him to maintain closer contact with his friends in that area.

Mr. F. Newey.—The Lincoln City Council has confirmed the appointment of Mr. F. Newey as city electrical engineer in succession to Mr. Stanley Clegg who is retiring. Mr. Newey is at present electrical engineer to the Long Eaton Urban District Council.

Lt.-Col. J. B. Dodge has been elected to the board of the Nigerian Electricity Supply Corporation, Ltd. He will represent the preferred ordinary shareholders.

Mr. S. C. Fudge, an electrical engineer with the English Electric Co., Ltd., Stafford, was married on June 3rd to Miss Dorothy May Johnson, of Stafford.

Mr. W. Redmayne, now distributing engineer, is recommended by the Rotherham Electricity Committee for the position of chief assistant engineer. The post is rendered vacant by the appointment of Mr. W. H. Duffett as borough electrical engineer and manager.

Sir Hugo and Lady Hirst (seated in the centre), Mr. and Mrs. M. J. Railing and friends at the G.E.C. sports

Mr. R. H. Tree, who is retiring from the position of chief clerk of the Institution of Electrical Engineers, is to receive an expression of appreciation from the members of the Institution. A fund has been opened and Sir Arthur Preece has consented to act as hon. treasurer. Subscriptions made payable to him should be sent to the Institution not later than June 26th. It is proposed to spend a comparatively small sum on a personal memento and to present the balance as a cheque to Mr. Tree.

Mr. C. M. Lamplugh, of the Bridlington Corporation electrical staff, was married on June 2nd to Miss D. Pycroft, of Castleford.

Mr. T. Carruthers, of the staff of the Blackburn Corporation Electricity Department, was married recently to Miss Irene Arrowsmith, and was presented by his colleagues with an oak clock.

Mr. D. Macfarlane Macleod, M.I.E.E., who, until recently, was chief engineer of the Clyde Valley Electrical Power Co., has been appointed Scottish manager for Electrical and Engineering Products, Ltd., whose Glasgow offices are at 7, Elmbank Street. Mr. Macleod was with the Clyde Valley Co. for about twenty-seven years until last March, and is well known in Scottish engineering circles. He was chairman of the local centre of the Institution of Electrical Engineers in 1927-1928.

Mr. D. Macfarlane Macleod

Salary Increases at Liverpool.—A list of recommendations for salary increases to members of the staff of the Electric Supply Department has been made to the City Council. Special payments have been made annually to those whose names are scheduled during the period the Clarence Dock power station has been under construction, and it is now proposed to stabilise their remuneration. The following are the proposed new salaries:—Mr. J. Hamilton, superintendent of generation, £1,000; Mr. E. L. Morland, superintendent engineer of distribution, £950; Mr. L. Breach, chief electrical assistant, £825; Mr. A. C. Hansen, engineer's secretary, £550; Mr. H. A. W. Williams, resident engineer, £625; Mr. K. M. Fergusson, station superintendent, £575; Mr. S. R. Hollway, £490; Mr. H. Midgley, chief technical assistant, £950; and Mr. H. Pryce-Jones, assistant technical engineer, £450.

Mr. G. E. W. Crowe was re-elected chairman for the coming year of the Household Appliances Section of the London Chamber of Commerce, Inc., at the annual meeting held on June 8th.

Mr. J. M. Crawford, chief engineer of telegraphs in the Australian Postmaster-General's department, has been elected chairman of the Melbourne Division of the Institution of Engineers, Australia.

Mr. A. J. Christie, deputy director of Posts and Telegraphs in Victoria, Australia, has retired after forty-seven years' service. He has held many positions in the department, and was appointed deputy director in 1931.

Mr. A. P. Young, manager of the British Thomson-Houston works at Rugby, has written a book entitled "Forward from Chaos." It deals with planned and co-ordinated control of industry, and will be published by James Nisbet & Co., Ltd., on June 19th.

Mr. A. Forster, at present general manager of the Stockton-on-Tees Transport Department, has been appointed by the Council to the post of consultant at £300 per annum. It is intended to advertise for a new general manager to fill Mr. Forster's place at £700 per annum, rising to £800. Mr. Forster recently had a serious breakdown in health and was unable to carry on his duties.

Professor Wolfgang Gaede is to be presented with the Duddell Medal at a meeting of the Physical Society to be held at the Imperial College of Science and Technology this evening (Friday).

Mr. F. Jervis Smith has been elected chairman of the London Students' Section of the Institution of Electrical Engineers for the session 1933-34, and **Mr. T. S. Smith** has been elected vice-chairman.

Mr. W. H. Metcalfe, electrical engineer to the Bacup Town Council, has received an increase in salary to £500 per annum as from July next. At a recent meeting of the Council the chairman of the Electricity Committee stated that there had been a general increase in the supply of electricity and the net profit for the year was £3,180, as compared with £2,094 in the preceding year.

Obituary

Mr. J. A. Constable.—The death occurred suddenly on June 4th of Mr. J. A. Constable, chief station engineer of the South Metropolitan Electric Light & Power Co.'s station at Blackwall Point, East Greenwich. The funeral took place at the Greenwich Cemetery last Friday, and was attended by a large number of the company's staff and employés. By the loss of Mr. Constable the industry is deprived of one of its pioneers, for he was associated in the very early days with Mr. Arthur Wright at Brighton when electric lighting distribution was carried out on the old series system. He was afterwards assistant engineer at the House-to-House Electric Lighting Co.'s station at Richmond Road (now a sub-station of the Brompton & Kensington Electric Supply Co., Ltd.), and was subsequently appointed resident engineer of the Blackheath & Greenwich Electric Light Co., Ltd., when the Blackwall Point station was started in 1899. When the activities of the Blackheath Co. grew and it became the South Metropolitan Electric Light & Power Co., Ltd., Mr. Constable became chief station engineer, and retained this position until his death. The Blackwall Point station, under his guidance, achieved remarkable results for its size, and was chosen by the Central Electricity Board as a " selected " station.

The late Mr. J. A. Constable

Mr. J. F. Roach.—The death has taken place, at the age of sixty-two years, of Mr. James Frederick Roach, electrical engineer, Macclesfield. Mr. Roach went to India in 1920 for the Indian Ordnance Department to supervise the erection of a Government power station, of which he subsequently had charge. After ten years' service he had to resign owing to ill-health.

Dr. J. Henderson.—The death occurred on June 9th at his home at Beaconsfield of Mr. J. Henderson, D.Sc., M.I.E.E., F.R.S.(Edin.), at the age of sixty-one years. He attended the Heriot-Watt College, Edinburgh, from 1888 to 1893, and during the last year was demonstrator there. For the next five years he was lecturer in physics and electrical engineering at Manchester, and in 1899 came to London as head of the Electrical Department of the Borough Polytechnic, which position he held for some years. He became a member of the Institution of Electrical Engineers in 1912.

Notes

Generation of Electricity

The official returns rendered to the Electricity Commissioners show that 1,004 million kWh of electricity was generated by authorised undertakers in Great Britain during May, as compared with the revised figure of 895 million kWh in the corresponding month of 1932, representing an increase of 109 million kWh or 12.2 per cent. During the first five months of 1933 the total amount of electricity generated by authorised undertakers was 5,603 million kWh, as compared with the revised figure of 5,269 million kWh for the corresponding period of 1932, an increase of 334 million units or 6.3 per cent.

A Radio Patent Action

In the Chancery Division on Tuesday last, Mr. Justice Maugham (sitting with Professor E. V. Appleton as assessor) commenced the hearing of the action brought by Marconi's Wireless Telegraph Co., Ltd., against Philip's Lamps, Ltd., to recover damages for alleged infringement of plaintiffs' letters patent No. 13636 of 1913, granted to the plaintiff company and Charles Samuel Franklin for an invention for improvements in receivers for use in wireless telegraphy and telephony.

Mr. Whitehead, K.C., for the plaintiffs, stated that the patent had expired in 1929, and the writ in the action was issued on December 1st, 1930, so that plaintiffs could only ask for damages. Originally there were two patents involved, the other being No. 147148, granted to the British Thomson-Houston Co., Ltd., for an invention of improvements relating to electron discharge devices, but in the course of the proceedings the defendants amended the particulars of objection, and the plaintiffs elected to discontinue their action in respect of patent No. 147148. The defendants challenged the validity of the patent, pleading prior publication, prior common general knowledge, and lack of subject matter and utility. They also pleaded ambiguity alleging that the specification was misleading and insufficient to enable the purported invention to be carried into effect.

Millions of receiving sets had been produced, each of which had made use of the invention protected by the patent, and in practically every case the user had been under licence. The claim made by the patent was for "a receiving system for electrical oscillations which contains a valve for magnifying oscillations and which is so arranged that the circuit in which are set up the magnified oscillations reacts on the circuit in which occur the oscillations to be magnified."

Mr. Whitehead had not concluded his address at the rising of the court, and the hearing was adjourned.

An Antidote for Electric Shock

Experiments at the Johns Hopkins University have shown that an electric shock of high voltage is an antidote for an otherwise fatal shock from low voltage. According to the *Electrical World* it has been demonstrated that a "fibrillation" set up in the heart by the low-voltage shock is halted through application of the higher voltage and normal pulsation is permitted to be resumed. A fibrillation, Dr. W. B. Kouwenhoven, who conducted the experiments, explained, is a condition of the heart muscles when co-ordination is stopped and the muscles twitch spasmodically, disrupting circulation of the blood.

Society of Chemical Industry

The proceedings at the annual general meeting of this Society, which is to be held at Newcastle-on-Tyne from July 10th to 14th, will include a visit to the Dunston power station of the North-Eastern Electric Supply Co., Ltd. A paper is to be presented by Dr. S. L. Pearce on the application to the Battersea power station of researches into the elimination of noxious constituents from flue gases and the treatment of resulting effluents.

South Shields Tramway Inquiry

Following an allegation of maladministration the affairs of the South Shields tramway undertaking, the Town Council has appointed a committee of five councillors to hold an inquiry into the charges. Alderman J. Dunlop, who moved that a committee of inquiry be set up, declared that the Tramways Department was in a "state of chaos." He condemned the policy of buying second-hand tramcars and reconstructing them. He questioned the statement that the cars were reconstructed and made up-to-date at a cost of about £400 each. Alderman C. A. Henderson, chairman of the Tramways Committee, said that the Committee did not fear an inquiry, and in some ways he welcomed it. Colonel R. Chapman, M.P., stated that for the past twelve years he had watched the reserve fund gradually disappear. Five members who are not on the Tramways Committee were elected to hold an inquiry.

Appointments Vacant

Assistant in the departments of electrical engineering and mathematics at Dundee Technical College and School of Arts.

Junior assistant in the Electrical Engineering Department at the Royal Technical College, Glasgow.

Assistant engineer for Exminster Mental Hospital.

Inspector of wireless equipment for the Air Ministry.

Sub-station shift engineer and assistant shift engineer for the Brighton Electricity Department.

Assistant meter engineer for the West Gloucestershire Power Co., Ltd.

(See our classified advertisements.)

Floodlighting with Gas-discharge Lamps

During the I.M.E.A. Convention at Bournemouth the Royal Bath Hotel is being floodlighted by the new "Mazda Mercra" lamps, thirty-six 400-W lamps, housed in specially designed projectors, being employed to light the two wings of the hotel.

The "Mazda Mercra" is a glow discharge lamp which will work directly off ordinary supply mains, the space between the two electrodes containing mercury vapour. This enables 45 lumens per watt to be given off, as compared with 15 lumens per watt in the case of the most efficient filament lamp. The size is 11½ in. long by 1¾ in. in diameter. An illustration of the lamp appears herewith. A view of the floodlighted Royal Bath Hotel is on page 877.

The new "Mazda Mercra" lamp

Makers' Names Wanted

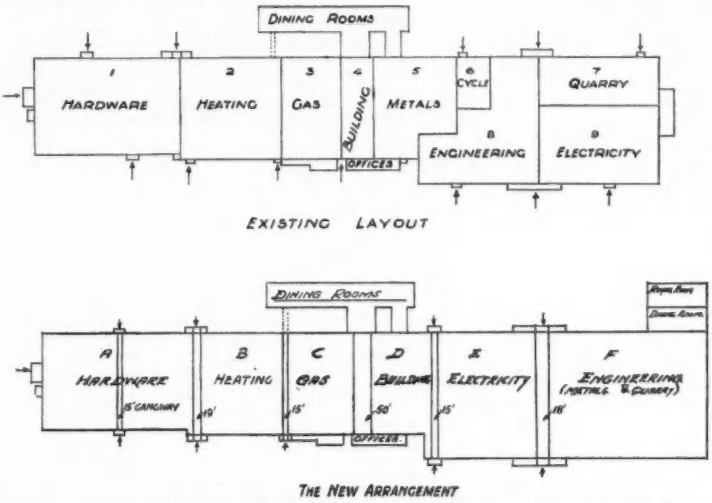
MAUTHE chromium-plated electric alarm clock.

Business and Industrial Notes

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures

The Marking of Electrical Accessories

Following the inquiry last April into the application of the British Electrical and Allied Manufacturers' Association for the marking of certain imported electrical accessories, the Standing Committee (Merchandise Marks) has now issued its report (H.M. Stationery Office, 2d.), and recommends that the following items shall bear an indication of origin on sale or exposure for sale, both wholesale and retail: Lampholders, ceiling roses, adaptors for lampholders, switch-plates, and the following articles up to and including 30-A rating: Switches, cut-outs, fuses, wall sockets, plugs and plug adaptors for wall sockets, and plugs and sockets for use as connectors to portable or mobile appliances. For cartridge fuses less than ½ in. in diameter and 2 in. in length and for switchplates of glass it will be sufficient if the indication of origin is stamped or printed on a label affixed to each article, but for the remainder of the articles the indication of origin must be die-stamped, impressed, embossed, engraved or moulded on. Where goods are sold in cartons or other containers, the latter must have the indication of origin stamped on them. It is proposed that the Order shall come into force three months after the date on which it is made or January 1st, 1934, whichever is the later.



The improvement in the layout of the British Industries Fair, Birmingham, which is referred to in our leading columns this week

Advertising and World Recovery

Fifteen hundred delegates will attend the ninth annual convention of the Advertising Association, which will be held in London from July 18th to 21st. The convention will be opened by the Prime Minister, and the whole Empire will be represented, as well as many foreign countries. One of the principal subjects to be discussed is how advertising can best be employed to hasten the return of the world to normal conditions. Running concurrently with the convention will be the Advertising Exhibition, which opens at Olympia on the previous day, July 17th. Full particulars regarding the programme of the Advertising Convention may be obtained from Mr. G. Russell Chapman, Secretary of the Advertising Association, 110, Fleet Street, E.C.4

Worthing Showroom Decision

The Worthing Town Council decided at its meeting last week not to proceed with a proposal to spend £18,000 on new showrooms in Chapel Road at present, a complaint having been made that the Electricity Committee had not had an opportunity of considering the figures.

Chinese Telephone Apparatus Manufacture

The works for the manufacture of telegraph instruments established by the Chinese Ministry of Communications at Shanghai is to be enlarged to include the manufacture of telephone apparatus and instruments in order to reduce imports.

The Northants Agricultural Show

The many ways in which electricity can be used on the farm and in the home were demonstrated at the joint stand of the Kettering Electricity Department and the Northampton Electric Light and Power Co., Ltd., at the Northamptonshire Agricultural Show held at Kettering last week. Other exhibitors included Messrs. Parnett and Soans, who displayed electric dairy machines, refrigerating equipment, and portable drills, and Messrs. Paul Taylor, on whose stand was the latest in radio and relay equipment.

Swimming Bath Floodlighting

An excellent example of open air bath floodlighting is to be seen at Wembley, where Holophane, Ltd., in conjunction with the North Metropolitan Electric Power Supply Co., has just completed an installation. The result obtained from twelve 500-W "E" type Holophane units is most spectacular and effective.

Eton Celebrations

Floodlighting was brought into use this year for the first time in the history of Eton's famous Fourth of June Celebrations. It was applied to the procession of boats on the river with very great success, the scheme being carried out with G.E.C. floodlights.

Side-entry Circulators

Referring to the notes in our last week's issue (p. 813) relating to their side-entry circulator, Messrs. Archibald Low & Sons, Ltd., point out that to the sentence "A small supply of hot water is available in a few minutes, and when the tank is heated up there is difference between the top and the bottom" should be added "equivalent to the difference by an ordinary immersion heater."

Soviet E.H.P. Transformer Manufacture

The first extra high pressure transformer produced in the U.S.S.R. (of 60,000-W capacity) was successfully tested a few days ago at the Electrocombinat, the electrical equipment plant in Moscow. The transformer is made exclusively of Russian materials, and will be installed at the Svir-Leningrad transmission line, the first 220,000-V line in the U.S.S.R. It has been tested at a pressure of 461,000 V, and it weighs 120 tons. Another twelve transformers are to be produced this year for the Svir station. During the past two years the electrical equipment industry of the U.S.S.R. has produced no fewer than one hundred and eighty large transformers with a rating of 110,000 V.

Change of Name

Messrs. Chesterton, Jones & Co., Ltd., Birmingham have changed their name to C. Wright (Investments & Estates), Ltd.

A Waterproof Label Material

The accompanying illustration of a group of exhibits at the Plastics Industry Exhibition at the Science Museum, South Kensington, represents a new development of the Metropolitan-Vickers Electrical Co., Ltd., which is showing labels, signs, street nameplates, and decorative panels. These products are a result of the company's research work on synthetic resins, during which a process has been devised for manufacturing articles which are weatherproof and, in addition, resist oils, greases, and corrosive atmospheres. This material should be particularly useful to electrical manufacturers, contractors, and supply authorities for switchboard labels, danger signs, and transmission pole number plates, as well as for connection diagrams and notices which have to be fixed in exposed posi-

Examples of the applications of "M.V. Traffolyte" at the Plastics Industry Exhibition

tions. The process was developed by the company in its efforts to discover a method of producing connection diagrams for outdoor transformers, and the product has now been put on the market under the name "M.V. Traffolyte."

The E.D.A. Cooking Campaign

"A Chef and a Maid at Your Finger-tip" is the key-phrase of the British Electrical Development Association's new cooking campaign, further particulars of which are now available.

A window display suggested in connection with the E.D.A. Cooking Campaign

During this month extensive advertising is being carried on by E.D.A. in the Press throughout the country, and supply authorities are invited to co-operate by inserting in local papers advertisements, suggestions for which appear in the published programme for the campaign. It is suggested, too, that suppliers should follow this up by sending to cooking prospects copies of attractive publications entitled "I don't feel Half so Tired" (E.D.A. 1170), "A Chef and a Maid at Your Finger-tip" (E.D.A. 1171), and "Electric Cooking" (E.D.A. 992), enclosing at the same time brief particulars of hire and hire-purchase terms, rates and tariffs and one or two testimonials obtained from satisfied consumers. The attractive 30-in. by 20-in. poster (E.D.A. 1098) illustrated in our May 26th issue (page 749) is available for hoarding displays as well as another poster (E.D.A. 993) which links up closely with the booklet "Electric Cooking." For the assistance of demonstrators in showrooms a manual has been prepared entitled "How to Demonstrate an Electric Cooker," a copy of which will be sent free of charge. A picture of a suggested window display appears above.

Lighting the World Economic Conference

A feature of the conference hall at the new Geological Museum, in which the World Economic Conference was opened on June 12th, is the system of shadowless lighting obtained by indirect lighting fittings made by the General Electric Co., Ltd. These have silvered glass reflectors equipped with 1,000-W class "B" "Osram" projection lamps. There are over sixty of these fittings, and the excellent results obtained can be judged from the accompanying illustration. The company states that this is the first occasion upon which this system of lighting has been employed on such a large scale in this country. Gent's "Pul-syn-etic" electric clocks have been installed throughout the new museum.

The lighting of the Conference Hall at the Geological Museum, Kensington

Sheffield Week

In connection with Sheffield Week to be held from June 24th to July 1st, the Sheffield Chamber of Commerce has prepared a book of 164 pages entitled "The Quality of Sheffield." This will be on sale on Monday, price 1s., and besides containing a history of the growth of the city and its industries, draws attention to the prominent architectural features and beauty spots of the district. Some of the more interesting points regarding the electricity undertaking and the new Blackburn Meadows power station are dealt with briefly. Throughout the publication numerous excellent illustrations appear.

Northmet Publicity

Two very striking advertisements have recently been inserted in several local newspapers by the North Metropolitan Electric Power Supply Co. in connection with its cooking and hot-water campaign. One bears the slogan "Let electricity do your cooking and obtain more leisure," while the other points out that electric water heating is both "instant, constant and cheap."

Irish Free State Electrical Imports

A fair degree of activity continues to prevail in the electrical trade in the Irish Free State, the imports of electrical machinery, fittings, and cognate apparatus and material attaining a value during April last of £57,001, as compared with £52,549 in April, 1932. The table below gives the aggregate imports during the first four months of the current year, the total showing an increase of £28,679, or over 14 per cent.

	JANUARY–APRIL. 1932. £	1933. £
Electrical machinery	65,749	47,409
Electric wires and cables	28,527	22,863
Wireless sets and parts	40,945	76,781
Electric lighting accessories, fittings and parts	14,725	14,579
Other electrical goods	45,976	65,130
Copper wire	2,525	364
Total	£198,447	£227,126

By a printer's error in our issue of May 26th (page 750) the table of Irish Free State electrical imports gave the figures for January-March, 1932, in the column for January-March, 1933, and *vice versa*. As stated correctly in the text there was an increase of £24,227 in the total imports for the period under review.

Trade Announcements

Electrical & Engineering Products, Ltd., Coastal Chambers, 172, Buckingham Palace Road, S.W.1, have been appointed agents for Messrs. G. P. Cosway, Ltd., for Glasgow and the whole of Scotland. Mr. D. Macfarlane Macleod, 7, Elmbank Street, Glasgow, will act as manager and deal with all inquiries in this area.

The Sales Department of Edison Swan Cables, Ltd., has been moved to 155, Charing Cross Road, London, W.C.2. The telephone number is Gerrard 8660 and the telegraphic address "Nawside, Westcent, London."

The Bankers Commercial Security, Ltd., has moved to larger offices at 17/19, Stratford Place, Oxford Street, W.1.

Messrs. J. H. Tucker & Co., Ltd., have transferred their Scottish sales organisation to more central and commodious premises at 17, Bothwell Street, Glasgow. The telephone number and telegraphic address remain unchanged.

Mr. R. H. Spence, late of 9, Station Road, Egham, informs us that he has disposed of his electrical business to a company styled Spence (Contracting), Ltd., and his radio business to a company called R. H. Spence & Co., Ltd. Both these companies are carrying on business at 9, Station Road, Egham.

Mr. W. D. Erskine, electrical engineer and contractor, Dumfries, has removed his business to 124-126, Queensberry Street.

The Electricity Supply Rifle League

As a result of the May matches, the leaders of the various divisions of the Electricity Supply Rifle League are as follows:—Division 1: City "A." Division 2: London Power Co. "B." Division 3: Kensington and Knightsbridge.

New Australian Companies

New companies recently registered in Australia include: The Albion Electrical Co., Pty., Ltd., electrical contractors (capital, £5,000), which has been formed to acquire the business carried on by William Jepson at 71, Queen's Bridge Street, South Melbourne, Victoria; the 2LE Radio Corporation, Ltd. (capital, £20,000), to acquire the assets and liabilities of the syndicate comprising Andrew G. Noble, Leonard N. Schultz, and Roy G. Lamb, for purposes of establishing a

broadcasting station, &c. (This company states that it intends to build, in New South Wales, the biggest licensed broadcasting station in Australia); Radiovision (Aust.), Ltd., Margaret Street, Richmond, Victoria (capital, £60,000), to commercialise television inventions of I. L. Maguire; and Reg. Rose & Co., Ltd., Sydney (capital, £25,000), importers and suppliers of electrical goods.

The Australian Radio Industry

According to the Melbourne *Argus*, representatives of broadcasting stations and of firms engaged in making, distributing, and selling wireless receivers have decided to form a company with a nominal capital of £100,000 to protect their interests, particularly in patent and copyright questions. In addition there will be a Federal association, to act on matters affecting listeners, broadcasters, and manufacturers. This decision follows the announcement of the Federal Ministry's proposal to terminate the patent royalty agreement between it and Amalgamated Wireless (Australasia), Ltd.

Recent Contracts

Among the emergency cinema lighting installations recently completed by the Chloride Electrical Storage Co., Ltd., are

An interior view of one of the portable huts used by the North Metropolitan Electric Power Supply Co. for demonstration purposes.

three for the Gaumont-British Picture Corporation—the Dominion Cinema, Tottenham Court Road, where a battery consisting of 110 " SFG5 " cells, 250-Ah capacity at the 10-hour rate, has been installed; the New Gallery, Regent Street, with 110 " DBG2 " cells, 60-Ah capacity at the 10-hour rate; and the Shepherds Bush Pavilion with 105 " DBG4 " cells, 120-Ah capacity at the 10-hour rate. All of these are of the floating battery type at mains voltage.

G.V.D. Illuminators have been awarded the contracts for the lighting of the Press Room at the World Economic Conference and the catalogue room of the British Museum.

One of the most important public address contracts secured by the Marconiphone Co., Ltd., has been carried out at the Radiovision (Aust.), Ltd., Margaret Street, Richmond, new Geological Museum building, South Kensington. Each vital piece of apparatus has been duplicated, and the new Marconi metal " Catkin " valve is being employed in the amplifiers.

The Use of Domestic Electrical Appliances

In an article in *L'Energia Elettrica* on the progress of electricity supply in Italy during 1931 by Ing. Ettore Cesari, manager of the Unione Nazionale Fascista Industrie Elettriche, a table appears showing the present use of domestic electrical appliances in the principal countries of the world. From this we have compiled the appended table giving for seven countries the number of such appliances in use per thousand of the total inhabitants and per thousand of the people residing in areas in which a supply of electrical energy is available.

	No. of appliances per 1,000 inhabitants.	No. of appliances per 1,000 residents in areas in which electrical energy is available.
Switzerland	207	209
Germany...	164	209
United States	162	233
France	154	164
Belgium	149	154
Italy	127	140
Great Britain	74	98

It will be seen that Switzerland is well ahead in its use of electrical appliances and that Great Britain is a very poor seventh. The table is also interesting in that it gives an indication of the extent to which supplies of electricity are available. Thus, the slight difference in the two figures set against Switzerland shows that an electricity supply is now available in practically every part of the Republic.

New Municipal Showrooms

Gillingham Electricity Committee has decided to obtain tenders for the erection of electricity showrooms, offices and sub-station in Gardiner Street.

East Ham Electricity Committee is applying for sanction to a loan of £6,580 for the acquisition of 703 and 705, Romford Road, for use as electricity showrooms.

E.A.W. Housecraft Diploma Examination

The first examination for the Electrical Association for Women diploma in electrical housecraft is to be held at various centres in England, Scotland and Wales in September. Full particulars may be obtained from the Director, E.A.W., 20, Regent Street, S.W.1. (See our classified advertisements.)

The Trolley-bus

We have received a copy of the *Trolley Bus Gazette* which has been prepared and published by the British Electrical Development Association. It is a publication consisting of four large pages covering trolley-bus progress matters. The need for simplification of trolley-bus legislation is discussed. The resurrection of the trolley-bus, trolley-bus trials at Bournemouth, pictures of British-built trolley-buses in many places overseas, and the case for the trolley-bus are the other contents.

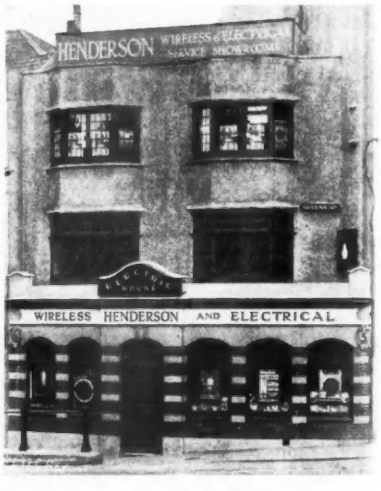
Social Events

The clerk of the weather, who, for many years has favoured the annual sports meeting of the London establishments of the General Electric Co., Ltd., was not so kind this year, and last Saturday's meeting was held for the most part under leaden skies. The weather was dry, however, and the interest which this event arouses among the members and their families is so keen that there was no diminution in the large gathering. We witnessed the usual rivalry of the various establishments for the many trophies, and the close finishes of the fifty events. The cool weather kept the spectators on the move, and the side-shows reaped a harvest in consequence. Sir Hugo and Lady Hirst received a hearty welcome for their presence indicated that they were enjoying better health; they stayed until the finish, when Lady Hirst presented the prizes. Others present were Mr. M. J. Railing, joint managing director, and Mrs. Railing, Mr. and Mrs. C. Wilson, Messrs. J. Y. Fletcher, F. Winstanley, J. H. Farthing, and C. C. Paterson, chairman of the Sports Committee, and Mrs. Paterson.

On Saturday last, a party of seventy-three left Welwyn Garden City *en route* for Skegness, the occasion being the annual works outing of Messrs. Young, Osmond & Young, Ltd. Lunch was provided at the Silver Grill, Drummond Road, the party being divided into two, one section presided over by Mr. E. M. Young, and the other by Mr. D. G. Petrie. Messrs. J. M. Young, R. C. Symondson, and H. P. Barker were unavoidably absent.

Henderson's New Brighton Offices

To meet growing trade the Henderson Electrical Wireless Service have just moved into more commodious premises in Queen's Road, Brighton. Like the firm's branches at Worthing and Tunbridge Wells, the new offices are called " Electric House," and have well-equipped showroom and store accommodation. Adequate stocks are kept of all the principal electrical and radio manufactures and accessories, including the new " Keyway " switchgear which the firm has just marketed.



" Electric House," Queen's Road, Brighton, the new premises of the Henderson Electrical and Wireless Service

Prices of Materials

Messrs. F. Smith & Co. report, June 14th: Electrolytic copper bars and sheets, no change. Electrolytic copper wire rods, £45, £3 dec. Electrolytic copper h.c. wire, 7 1/16d., ¼d. dec. Silicium bronze wire, 8¾d., ¾d. dec.

Messrs. Edward Till & Co. report, June 14th: India-rubber, Para, fine, 5¼d., ¼d. inc.

Messrs. James & Shakespeare report, June 14th: Copper bars (best selected), sheet and rod, no change; English pig lead, £14 15s., 5s. dec.

Future of Swansea Electricity Showrooms

The borough electrical engineer and borough architect of Swansea have been asked to go into the whole question of the future policy with regard to the Electricity Department's showrooms.

Vision in Industry

In many industries efficient eyesight is probably the most important factor contributing to high output, good work, diminished casualties, and the well-being and contentment of workers, but unfortunately too little care is paid to it. With the approval and support of the British Medical Association, the National Ophthalmic Treatment Board has prepared a scheme for the expert examination of the eyes of workers. The Board has arranged centres throughout the country with approved medical personnel and also for the supply by approved opticians at reasonable prices of the glasses prescribed. Particulars of this service may be obtained from the secretary of the Board (Industrial Section), 1, High Street, Marylebone, W.1.

For Sale

Worksop Electricity Department offers for sale generating plant, switchboard, storage battery, fans, &c.

The Esplanade Hotel, Seaford, has a complete electrical installation for sale.

Glasgow Corporation offers the entire plant at the Port Dundas power station for sale.

Hewittic mercury arc rectifiers are offered for sale by the Leyton Electricity Department.

(See our classified advertisements.)

New Catalogues and Lists

Leda Electric, Ltd., Nelson Street, Miles Platting, Manchester.—A folder relating to the "Leda" refrigerator.

R. F. Winder, Ltd., Belgrave Electrical Works, Leeds.—The June catalogue of surplus new and second-hand electrical material.

Dussek Bitumen & Taroleum, Ltd., Empress Wharf, Bromley-by-Bow, E.3.—Publications E.T.D.2 and 3/33, dealing with the subjects of reliability and safety in electrical transmission and distribution.

British Fan & Electric Co., 21, Mount Pleasant, Rosebery Avenue, W.C.1.—An illustrated price list of fans.

Igranic Electric Co., Ltd., 149, Queen Victoria Street, E.C.4.—Publications Nos. 695 and 6775, relating to "Dean" electric control for use with steam, water and gas valves, and electric motor control devices for d.c. and a.c.

London Electric Wire Co. & Smiths, Ltd., Playhouse Yard, Golden Lane, E.C.1.—A booklet dealing with modern armature winding for heavy-duty motors.

Siemens-Schuckert (Great Britain), Ltd., 30-34, New Bridge Street, E.C.4.—An illustrated folder giving particulars of the "Sirama" electric safety razor.

L. G. Hawkins & Co., Ltd., 30-35, Drury Lane, W.C.2.—The June issue of the "Link," containing details of the "Supreme" vacuum cleaners, fans, irons, &c.

Gregson Boreham, Ltd., 9/11, Marban Place, Bravington Road, W.9.—An illustrated catalogue of "Gregbolite" electric lighting fittings.

Lighting Trades, Ltd., and Welsbach Light Co., Ltd., 51-55, Garratt Lane, Wandsworth, S.W.18.—A 192-page illustrated catalogue (No. 304) of modern lighting fittings, including new designs of the tubular type.

Falk, Stadelmann & Co., Ltd., 83-93, Farringdon Road, E.C.1.—A catalogue (No. 681) and folder (No. P.1630) relating to "Antarctic" electric fans.

Edison Swan Electric Co., Ltd., 155, Charing Cross Road, W.C.2.—A leaflet (No. H.C. 894) illustrating and describing "Ediswan" boiling rings.

Company Liquidations

Lotus Radio, Ltd., Liverpool.—The statutory meeting of creditors was held recently, at the Common Hall, Liverpool, Mr. J. J. Mead, one of the directors, occupying the chair. A statement of affairs was submitted which showed ranking liabilities of £74,709 and assets estimated to realise £49,707, subject to preferential claims of £1,472, leaving net assets of £48,235, or a deficiency of £26,474 so far as the creditors were concerned. The issued capital of the company was £71,431, all of which was fully paid. It was stated that the cash in the hands of the Receiver for the debenture holders would be subject to any further payments to be made by him. There was a contingent liability in respect of hire-purchase agreements which had not yet been completed, and, in addition, there was an agency agreement with Delta Radio Distributors, Ltd., which might form the subject of a claim. It was pointed out that the statement of affairs now presented differed somewhat from the one submitted at the informal meeting of the creditors held some little time ago. The chairman said that negotiations with regard to the proposed payment of 12s. 5d. in the £ to creditors had unfortunately fallen through. As a result the shareholders decided that the company should go into voluntary liquidation. The Receiver for the debenture holders gave notice that he had ceased to act on May 16th last. The Receiver realised certain of the assets of the company and out of the proceeds had paid the amounts claimed by the debenture holders. Various proposals were submitted regarding the appointment of a liquidator, but no decision was arrived at. Certain of the largest creditors intimated that they might apply to the Court for the appointment of a liquidator nominated by the creditors.

Neolight Signs Co., Ltd., Ladybarn Road, Fallowfield, Manchester.—At the statutory meeting of creditors held recently at the company's offices, the statement of affairs showed liabilities of £5,339, and assets estimated to realise £2,496, leaving a deficiency of £2,843, so far as the creditors were concerned. It was reported that the shareholders had already met and had nominated Mr. Parker, of Messrs. Parker, Gradwell & Co., accountants, of Manchester, and Mr. Bowers, the secretary of Neolight Signs Co., Ltd., and Mur-Ray Signs, Ltd., to act as joint liquidators. The creditors confirmed the appointment of those two gentlemen as liquidators, and also nominated a committee consisting of the representatives of Neolight, S.A.; the Protector Lamp Lighting Co., Ltd.; Goodlass, Wall & Co., Ltd.; Neolight Signs Co., Ltd., and Mur-Ray Signs, Ltd.

Davis Electrical Co., Ltd., wholesale electrical suppliers, 6, Warwick Court, W.C.1.—The statutory meeting of creditors was held on June 9th at the offices of the Electrical Traders' and Importers' Association, 1, 2 and 3, Oxford Court, Cannon Street, E.C.4, when Mr. Davis, the managing director of the company, presided. It was stated that the liabilities amounted to £1,183,

The E.L.M.A. demonstration van which is to tour the provinces. This week it has been at Bournemouth in connection with the I.M.E.A. Convention

of which £546 was due to the trade, and, after allowing £25 for preferential claims, the deficiency was £1,030. The issued share capital of the company was £677, so that the total deficiency to be accounted for was £1,707. A resolution was passed appointing Mr. B. G. Arthur liquidator of the company.

Holder's Health Appliances, Ltd.—Meeting July 6th at 11, Queen Victoria Street, E.C.4, to hear an account of the winding up by the liquidator, Mr. W. T. Flower.

Bankruptcy Proceedings

F. J. Woolfenden and **J. D. Lister** (trading as Frank Woolfenden and Lister), electrical and radio engineers, 56, Victoria Street, Littleborough, near Rochdale, Lancs.—These debtors attended recently at the County Court Buildings, Rochdale, for their public examination. The joint statement of affairs lodged showed liabilities of £149, with assets estimated to realise £116, leaving a deficiency of £33. The separate estate of Woolfenden disclosed liabilities of £167, with assets of £8, and a deficiency of £159, while Lister had no assets and liabilities of £203. The examinations were formally adjourned.

J. S. Lowden (otherwise known as H. R. Bishop), wireless dealer, 175, Piccadilly, London, W.—This debtor presented his petition on May 24th, and the statutory first meeting of his creditors was held on June 8th at London Bankruptcy Buildings. A statement of affairs was submitted showing liabilities of £2,798, and assets of £36 required, however, in payment of preferential claims. The debtor attributes his insolvency to losses in a valve business (which was conducted under management), through inexperience of the trade and to depreciation of another business which he had conducted, owing to the slump in trade. The estate remains in the hands of the Official Receiver.

E. Cohen (trading as Manor Wireless Supplies), 746B, Romford Road, Manor Park.—The statutory first meeting of creditors was held on June 8th at London Bankruptcy Buildings. The receiving order was made on May 26th upon the petition of Messrs. V. Zeitlin & Sons, Ltd., the act of bankruptcy alleged being notice of suspension of payment. Mr. H. H. Gaine, Assistant Official Receiver, reported that he had only just received a preliminary list of the creditors and the meeting was adjourned for one week.

B. Hetherington, wireless dealer, Westgate, Elland, Yorks.—The first meeting of creditors took place at the Official Receiver's Office, Hallfield Chambers, 71, Manningham Lane, Bradford, when it was disclosed that there was a deficiency of £276. Debtor attributed his failure to lack of capital, keen competition, and losses sustained on hire-purchase agreements. The case being a summary one was left in the hands of the Official Receiver, as trustee.

J. Stewart, radio dealer, 10, Murton Street, late Seaside Lane, Easington Colliery, Durham.—The public examination was resumed recently at the County Court, Sunderland. The statement of affairs lodged showed ranking liabilities of £1,202, and the deficiency was estimated at £1,063. The examination was again adjourned.

Meetings of Creditors

Junit Manufacturing Co., Ltd.—A meeting of creditors was to be held on June 12th at Norfolk House, Kingsway, W.C.2.

Makin & Co., Ltd.—A meeting of creditors was to be held last Friday at 9-11, Figtree Lane, Sheffield.

Electricity Supply

Lighting, Domestic, Power

Aldershot.—CHEAPER ELECTRICITY.—The Town Council has adopted a recommendation by the Electricity Committee for the reduction of electricity charges to ordinary consumers.

Bacup.—YEAR'S WORKING.—The Electricity Department made a net profit last year of £3,180, as against £2,094 in the previous year.

Blackburn.—YEAR'S WORKING.—With reference to the note which appeared in our issue of May 26th (p. 753) regarding the operation of the Corporation electricity undertaking during the past year, Mr. W. A. Royle, the borough electrical engineer and manager, points out that the figure given for the year's surplus (£1,670) is liable to give a wrong impression. Actually the net trading profit was £8,347, and it was after appropriating £4,784 for capital expenditure out of revenue, £1,624 for final contribution to sinking fund for original cooling towers, and £269 on excess expenditure on cooling towers, that the balance of £1,670 remained. Under the sale of fittings account a sum of £1,261 was also taken as a final contribution to writing off the whole of the cost of the cookers installed on hire, there being a credit balance on this account of £1,540.

Blackpool.—STREET LIGHTING IMPROVEMENTS.—The electrical engineer has been instructed to report on improving the lighting of Whitegate Drive.

Bolton.—CHEAPER ELECTRICITY.—Concessions amounting to about £12,000 have been made to electricity consumers in Bolton. For lighting and domestic purposes the rate is reduced from 4½d. to 4¼d. per kWh, and consumers whose charges are based on the number of rooms are charged a lower rate of ½d. per kWh at the end of a reduced number of hours in both summer and winter. For industry and power the charges vary according to the quantity consumed, but the reduction represents an average decrease of from 5 per cent. to 6 per cent.

Bradford.—TRANSFORMER CHAMBER.—The Electricity Committee is to erect a transformer chamber costing £5,723 at Dick Lane.

Bristol.—MAINS EXTENSIONS.—The Electricity Committee is to extend mains at a cost of £6,000 to supply mills being erected at Avonmouth Dock by Messrs. Spillers, Ltd., and Messrs. R. & W. Paul, Ltd.

Bromley (KENT).—GREEN STREET GREEN SUPPLIES.—The West Kent Electric Co., Ltd., has submitted to the Rural District Council proposals for extending the electricity supply at Green Street Green by means of a dual system of underground and overhead distributors. The Council has decided not to object to the overhead cables subject to their removal as the areas become developed. The Council is also to negotiate with the company with respect to its proposals for the erection of temporary overhead cables in sparsely developed areas.

Chichester.—SUPPLY TO AIR MINISTRY.—The City Council has adopted a draft agreement with the Air Ministry for supplying electricity to Tangmere.

UNDERTAKING PURCHASE OFFER REJECTED.—The Council has decided not to consider further an offer from the Mid-Southern Utility Co. for the purchase of the undertaking for £200,000.

Chipping.—ELECTRIC LIGHTING FOR CHRISTMAS.—The streets of Chipping will be lighted at Christmas by electricity. At present there is no street lighting, and oil lamps are used in the houses.

Chesterfield.—LOANS SANCTIONED.—Sanction has been received by the Electricity Committee to loans of £2,500 for mains and £3,370 for a sub-station and switchgear.

China.—NEW POWER STATION.—Detailed plans and estimates, drafted by engineers of the National Reconstruction Commission and the Yangtze River Conservancy Commission, for the construction of a 20,000-kW hydro-electric station at Ichang, have been submitted to the Executive Yuan for consideration.

Cleckheaton.—LOAN FOR CABLES.—The Urban District Council has applied for sanction to a loan of £3,000 for cables for three years.

Colchester.—YEAR'S WORKING.—A total revenue of £134,561 and a net surplus of £8,348, are recorded by the Electricity Department for the past year.

Colne.—MAINS AND SERVICES.—The Town Council has received sanction to the borrowing of £7,500 for mains and services.

Crewe.—AGREEMENT WITH CENTRAL BOARD.—At a recent meeting of the Town Council, Alderman H. Bullock said that the Corporation had entered into a very favourable agreement for a supply of electricity with the Central Electricity Board, which would enable the Council to sell electricity at as cheap a rate as any authority in the country.

Croydon.—JUBILEE ILLUMINATIONS.—On June 9th Croydon officially celebrated its jubilee of incorporation and a feature of the celebrations was an elaborate scheme of illuminations carried out under the supervision of Mr. F. Rendell-Baker, the borough electrical engineer. Four large searchlights have been installed in the belfry of the Town Hall which with the aid of coloured slides radiate powerful beams of light. Two specially constructed triumphal arches have been erected over Katherine Street and each of these contains over 600 coloured lamps, while a large number of lamps are placed between the bunting on each side of the thoroughfare. The Town Hall gardens are proving one of the greatest attractions, where festoons of lanterns and fairy lamps have been installed among the trees and flower beds, while other displays include an illuminated fountain, an ornamented peacock, butterflies and palm trees. The illuminations are being continued until next Sunday night. The greater portion of the scheme has been designed and installed by Implitico, Ltd. The brilliant effect of the triumphal arches can be seen in the illustrations on the opposite page, which we reproduce by the courtesy of the *Croydon Advertiser*.

Darlington.—MAINS EXTENSIONS.—The Town Council is to extend mains in Glebe Road.

Devizes.—HOUSE INSTALLATIONS.—The Rural District Council has decided to have fifty-four of its houses supplied with electricity and tenders for the wiring work are to be invited.

Folkestone.—APPLICATION FOR SUPPLIES.—The Town Council has received an application for electricity supplies from thirty-seven tenants of houses in Penfold Road.

PIERHEAD LIGHT CONVERSION.—The 7,000-c.p. gas pierhead light is to be replaced next month by an electric light of approximately 265,000 c.p.

France.—TRUYERE DAM COMPLETED.—What is said to be the largest dam in Europe, providing a reservoir containing 305,000,000 tons of water, was opened on Monday by the French President, M. Lebrun, on the Truyère, a mountain stream in the district of Aveyron. Between two rocky sides of a gorge 500 ft. deep, the great dam has been built to a height of 345 ft. and measures 720 ft. at the top. It was begun in 1929. The harnessing of this stream will provide water for a hydro-electric station which will supply Paris, more than 300 miles away.—*Reuter* (Paris).

Gellygaer.—LOAN.—The Urban District Council has applied for sanction to a loan of £1,500 for the erection of lines at Penybryn and Gellygaer.

Gillingham.—EXTENSIONS.—The Electricity Committee is to extend mains at a cost of £800 to supply the Hillfields Housing Estate, and erect a new sub-station in Cleave Road.

YEAR'S WORKING.—A net surplus of £1,543 for the past year is reported by the Electricity Department.

Glasgow.—MAINS EXTENSIONS.—The Electricity Committee is to lay distributing mains at a cost of £1,622.

Gloucester.—EXTENSIONS.—The City Council is to extend mains at Hempsted and provide a sub-station, at an estimated cost of £400.

Gravesend.—MAINS EXTENSIONS.—The Electricity Committee is to spend £1,550 on mains extensions.

Guildford.—ASSISTED WIRING.—The Town Council has decided to make the assisted wiring scheme applicable to the rural area, with an extra charge of 2d. per kWh until the cost of the installation and interest has been met.

Hastings.—MAINS EXTENSIONS.—The Electricity Committee is to extend mains to Winchelsea Road, Rye (£440), and to the New Park Estate, off St. Helen's Road (£1,350).

METERS.—Application is being made for sanction to a loan of £15,000 for meters.

Hereford.—SPECIAL ORDER.—The Shropshire, Worcestershire and Staffordshire Power Co. has applied to the Electricity Commissioners for a Special Order authorising it to extend its supply area to include part of the parish of Ross.

Houghton-le-Spring.—OVERHEAD LINES INQUIRY.—Mr. Gordon Tucker, representing the Ministry of Transport, held an inquiry last week into an application by the North-Eastern Electric Supply Co., Ltd., for permission to erect overhead lines in the parishes of Silksworth and Newbottle. The application was opposed by the Houghton Council on the ground that the overhead system would disfigure the countryside and that the distribution of electricity was more efficiently effected by underground cables. In his evidence for the company Mr. Robinson said that the increased cost if underground cables were insisted on would be 80 per cent. in one section of the proposed works, 85 per cent. in another, and 108 per cent. in a third. Mr. Tucker afterwards went over the routes selected for the lines, and later it was announced that the Houghton Council had decided to inform the Ministry that it would have electricity only by means of underground cables.

Ilfracombe.—NEGOTIATIONS WITH SUPPLY COMPANY.—At a meeting of the Urban District Council last week a communication was reported from the Electricity Commissioners enclosing a copy of a letter from Edmundson's Electricity Corporation, Ltd., on behalf of the Ilfracombe Electric Light and Power Co., Ltd., stating that the company had informed the Council at various times of its willingness to introduce a two-part tariff if it could get an assurance that the Council would refrain for a reasonable period from exercising its option to purchase the undertaking. Subject to security of tenure for a period to be agreed the company was quite willing to make reductions in the charges for power and heating and also to reduce meter rents, but it did not think that a reduction in the lighting flat rate should be pressed for by the Council at this stage. The Electricity Commissioners inquired whether the Council would send representatives to attend an informal conference in London. The Council decided to send representatives and to press for a general reduction in the flat rate. It was also agreed that the Council should confirm the

decision, communicated to the company in 1930, that the Council was not opposed to the idea of a suspension of its purchase option for a limited period, provided it received an adequate return for this.

Japan.—WATER-POWER INVESTIGATION.—An investigation covering a period of five years is to be carried out by the Communications Department into the possibilities of further developing water power in Japan.

Lincoln.—YEAR'S WORKING.—The Coporation electricity undertaking made a net profit last year of £11,107.

Littlehampton.—ELECTRICITY CHARGES.—A statement regarding the present position with regard to the supply of electricity in the town is to be made at the next meeting of the Urban District Council. Col. C. C. R. Murphy, the chairman, stated last week that the price of electricity would be 9d. per kWh.

Liverpool.—SUB-STATION EQUIPMENT.—It is proposed to spend about £9,000 on the replacement of switchgear in sub-stations in Liverpool and district, and to make alterations at the Cobbs Quarry and Oldham Place sub-stations at a cost of about £1,650. The equipment of the new sub-station in Grove Park will cost about £950, and that in Childwall Road about £900.

LOAN SANCTIONED.—Sanction has been received to the borrowing of £561,266 for the completion of the first stage of Clarence Dock power station.

ALTERATIONS AT CLARENCE DOCK.—The Clarence Dock Power Station Special Committee proposes to make certain alterations at the Clarence Dock station by substituting one or two chimneys of different construction for those now in use.

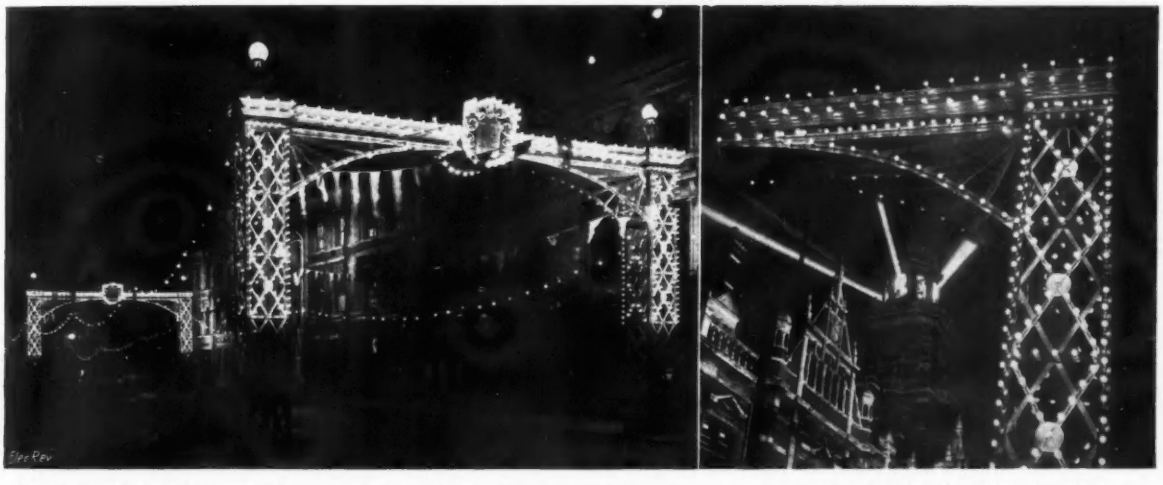
Council is hoping to proceed shortly with its scheme for supplying electricity to Fairfield.

Sutton Coldfield.—MAINS EXTENSIONS.—The Electricity Committee is applying for sanction to the borrowing of £5,000 for mains extensions. In order to meet the increasing demand and to enable progress to be made with the change-over from d.c. to a.c., the l.p. transmission system is to be strengthened considerably in portions of Wylde Green, Boldmere and Maney, at a cost of £3,505.

Thetford.—SUPPLY TO VILLAGES.—The Rural District Council has been informed by the East Anglian Electric Supply Co. that no schemes have been prepared for supplying electricity to parishes in the Council's district. The question of a supply to the larger villages would be further investigated next year; the company's decision would naturally depend on the demand.

Tonbridge.—REDUCED COOKING CHARGES.—The Urban District Council has reduced the charge for electricity for cooking and heating from 1½d. to 1d. per kWh in the town area, and from 1¼d. to 1¼d. in the outside area.

Totnes.—REPORT ON DEPUTATION TO COMMISSIONERS.—It was stated at a meeting of the Town Council last week, when a report was presented by a deputation which had conferred with the Electricity Commissioners in London, that the Commissioners were of opinion that the local electricity company should be in the hands of one of the central distribution authorities. The mayor said the various points at issue between the local supply company and the Council were debated with the Commissioners, and he believed a satisfactory result would soon be reached. The Council was not in any way re-



The triumphal arch erected in connection with the Croydon Jubilee, and an illustration showing details of the illuminations

FRINGE ORDER.—Application is being made to the Electricity Commissioners for a Fringe Order to enable the Corporation to supply Huyton Farm Estate, where it is proposed to equip a sub-station at an estimated cost of £900.

Newcastle-upon-Tyne.—A SUCCESSFUL YEAR.—Although the Corporation transport and electricity undertaking was estimated to show a profit of £33,212 for the year ended March 31st last, it was reported to the Transport and Electricity Committee that the profit was actually £42,346. The trams returned a surplus of £17,381, the buses £19,115, and the electricity undertaking £5,850. Although these figures are regarded as excellent in view of the present bad times they are £10,000 lower than those for 1931-32.

Northampton.—PUMPING PLANT.—The Water Committee is to install electric pumping plant at the Billing Road waterworks at an estimated cost of £1,750.

Runcorn.—NEW WATER-HEATING TARIFF.—The Mersey Power Co., Ltd. has introduced a new tariff of ½d. per kWh for water heating in Runcorn and elsewhere.

Sleaford.—REDUCED CHARGES.—The charge for power supplies has been reduced from 4d. to 3d. per kWh, and a two-part tariff is to be offered to domestic consumers as an alternative to the flat rate. An assisted-wiring scheme has been adopted, the repayments to be spread over four years, and it is also proposed to introduce a scheme for the hire of cookers.

Southport.—HIRE OF COOKERS.—A new range of "Revo" cookers is to be let out on hire on the following terms (including maintenance):—Type for families of two to four persons, 7s. 6d. per quarter; four to eight persons, 8s. per quarter; eight to twelve persons, 9s. per quarter.

South Shields.—ASSISTED WIRING.—The Town Council is applying for sanction to the borrowing of £3,000 for an assisted-wiring scheme.

Stafford.—YEAR'S WORKING.—The Electricity Committee reports a gross profit of £14,601 as compared with £12,727 in 1931-32 and a net profit of £5,569.

Stockton-on-Tees.—ELECTRICITY FOR FAIRFIELD.—The Town

sponsible for the inability of the company to furnish the supplies required by the consumers, and throughout had been desirous of arriving at a fair settlement. He said that the Council had reason to complain that in letters the company had sent to firms and individuals in the town it had unjustly placed the whole blame for delay upon the Council.

Walsall.—SUPPLY TO ESSINGTON.—The Electricity Committee is considering giving a supply of electricity for lighting purposes to the outlying district of Essington.

West Bromwich.—MAINS EXTENSIONS.—The Electricity Committee is to apply for sanction to the borrowing of £30,000 for mains extensions.

Weymouth.—REDUCTION IN CHARGES.—An increase in the net profit of the Electricity Department last year from £6,371 to £6,902 has led the Electricity Committee to recommend the following reductions in charges:—Lighting: from 6d. to 5½d. per kWh (with discount); cooking, water heating and domestic contract rates, from ¾d. to ½d. Alterations in meter rents are also proposed.

ROTARY CONVERTOR WANTED.—It is recommended by the Electricity Committee that tenders should be invited for a rotary convertor.

Wigan.—PRICE REDUCTIONS.—Reductions in the electricity tariff have been decided upon, involving a loss of £7,200 per annum in the revenue to the Electricity Department. The lighting flat rate will be 4d. instead of 4½d. in Wigan, and 4½d. instead of 5d. in the outlying districts.

YEAR'S WORKING.—The net profit on the past year's working of the electricity undertaking amounted to £25,604, as compared with £12,677 in the previous year. Consumption for traction purposes shows a decline owing to the cessation of so many tramway services, but in every other department the consumption shows an increase.

Wimbledon.—SPECIAL ORDER.—The Town Council is to apply for a Special Order suspending the purchase rights of the Merton and Morden and Malden and Coombe Urban District Councils over those portions of the undertaking within their area until the end of 1971, or on the expiration of any period of ten years after that date.

Wimborne.—OVERHEAD LINES.—The Bournemouth and Poole Electricity Supply Co., Ltd., has asked the Rural District Council for permission to erect overhead lines in certain areas of the district. While raising no objection, the Council has asked the company to use lattice towers instead of poles.

Wolverhampton.—EXTENSIONS.—The Electricity Committee is to extend mains at a cost of £4,100, and provide a sub-station in Bruford Road (£1,732).

Workington.—CHEAPER ELECTRICITY.—The Electricity Committee recommends the following reductions in charges:—Lighting (through prepayment meters), from 5½d. to 5d. per kWh; lighting (quarterly accounts), from 5d. to 4½d. The charge to assisted wiring consumers is to remain at 7½d. per kWh, the allocation being 2½d. per kWh towards the cost of the installation instead of 2d.

Worthing.—REDUCED LIGHTING CHARGES.—The Electricity Committee recommends a reduction of ½d. per kWh in lighting charges.

LOANS SANCTIONED.—Sanction has been received to the borrowing of £4,000 for new Electricity Department stores, £2,284 for supplying the sewage disposal works, and £1,176 for sub-station equipment.

YEAR'S WORKING.—A net profit of £11,214 for the past year is reported by the Electricity Committee.

STREET LIGHTING CONVERSION.—The Highways Committee has arranged to convert fifty-six gas lamps at Tarring to electricity this year.

York.—LOANS.—The Electricity Committee is to apply for sanction to the borrowing of £11,000 for assisted wiring, £7,000 for domestic appliances, and £1,000 for meters.

Traction

Algeria.—MINERAL RAILWAY ELECTRIFIED.—The 125-mile line from the port of Bone to Oued-Kheberit, which was constructed specially for the transport of minerals and phosphates, is now being electrified, and the ninety miles from Oued-Kheberit to Duvivier was opened last month. It is expected that the remaining thirty-five miles will be completed early next year. The cost of converting the complete line is estimated at 230,000,000 fr.

Australia.—SYDNEY TRAMWAYS.—Mr. Stevens, the New South Wales Premier, says that the statement that the Government proposes to sell the State tramways is untrue.

Austria.—RAILWAY ELECTRIFICATION CONTRACTS.—The contracts for the electrification of the Tauern railway have been allotted to the A.E.G.-Union, Brown-Boveri, Siemens-Schuckert and Elin companies.

Blackpool.—TICKET-ISSUING MACHINES.—New ticket-issuing machines on Blackpool trams are proving a success, and the Transport Committee is to purchase 240 more.

China.—TRAMS FOR NANKING.—*Eastern Engineering & Commerce* states that three routes have been mapped out by the Reconstruction Commission as the beginning of a tramway system for Nanking. The tram lines will be laid down in three stages at a cost of approximately $13,000,000.

Glasgow.—TRAFFIC SIGNALS.—A sub-committee appointed to inquire into traffic control in Glasgow recommends the Corporation to proceed with a scheme of automatic signals which will take three years to complete and will cost approximately £21,000. No fewer than ninety "Electromatic" signals will be required for the scheme.

Irish Free State.—COMPENSATION FOR DISPLACED CORK TRAMWAYMEN.—The *Irish Telegraph* states that the text of the Bill to provide compensation for the ex-employés of the Cork Tramway Co. has been issued. It proposes the appointment of a committee of three—a chairman appointed by the Minister for Industry and Commerce, a member nominated by Cork Corporation, and a representative of the Electricity Supply Board. Compensation is to be calculated on one-twelfth of the yearly salary or wages for each year of service, and shall be repayable by the Corporation and the E.S.B. in equal instalments over a period of twenty years to the Minister of Finance, who in the first instance will provide the money.

Italy.—RAILWAY ELECTRIFICATION.—A railway electrification scheme to extend over a period of twelve years has recently been drawn up by the Italian Ministry of Communications. The scheme, which covers about 2,740 miles of line, will be undertaken in three four-year sections. Included in the work is the electrification of the important Milan north-south line as far as Reggio di Calabria and also the Turin-Trieste line, and the sections of the system connecting Italy with Switzerland and Austria. The scheme will necessitate the erection of several additional power stations.

New Zealand.—TROLLEY-BUSES TO BE TAXED.—The *Electrical Engineer & Merchandiser* says that the Christchurch Tramway Board is very much disturbed by recent legislation classing trolley-buses as electric vehicles for taxation purposes. In addition to vehicles now in service, the Tramway Board is said to have four trolley-buses on order in England, and in view of the new taxation it would cancel the order if it could do so; if not it would probably have them converted into petrol buses.

Rotherham.—TRAFFIC SIGNALS.—The Town Council has received approval to the installation of vehicle-actuated traffic signals, costing £766, at the High Street and College Street junction.

Wallsend-on-Tyne.—AUTOMATIC TRAFFIC CONTROL.—The Town Council is making arrangements for the erection of automatic traffic signals at several junctions in the borough.

Warrington.—YEAR'S WORKING.—For the past year the tramways show a net profit of £2,027, as compared with £3,521 in the previous year.

Communications

Great Britain.—RADIO RELAY SERVICES.—The Friern Barnet U.D.C. Highways Committee entered into an agreement with Wired Wireless, Ltd., in July, 1932, for the installation of a broadcast relay service within the district. As the company has taken no steps to provide a service it is recommended that notice determining the agreement is to be served forthwith.

The Blackpool Highways Committee has referred applications from Radio Relays, Ltd., Rediffusion, Ltd., and Mr. A. Lord, to a sub-committee for consideration and report.

The Northampton Highways Committee recommends that, subject to an approved agreement, the privilege of providing a service in the borough be granted to Messrs. Turner Bros., as agents for a local company shortly to be incorporated.

The Abergavenny Town Council is investigating applications for permission to establish a service for the town.

The Trowbridge Urban Council has granted the Swindon Radio Relay Exchange, Ltd., permission to establish a service in the town, the company to pay the Council 7½ per cent. of the revenue, or a minimum sum of £50 a year.

The Bridlington Town Council has referred back for reconsideration a recommendation to enter into an agreement with Rediffusion, Ltd., the Corporation to receive 7½ per cent. of the net service rentals. Local dealers have stated that such a service would adversely affect their trade.

Hungary.—RADIO LICENCES.—The Hungarian Radio Co.'s licensed listeners numbered 322,163 in April last. There was a decrease of 3,394 during March, but the recent inauguration of four new relay stations (Pecs, Magyarovar, Miskolc, and Nyiregyhaza) which transmit the Budapest programmes, is expected to affect the situation favourably.

London.—A WORLD RELAY.—The King's address at the opening of the League of Nation's Monetary and Economic Conference in London on Monday was broadcast through 2,000 stations. Telephone lines carried his speech to the International Telephone Exchange, from which it was transmitted by land-line to every country in Europe; another telephone line was connected with Rugby, where there were beam transmissions to Canada, South Africa, South America, India and Egypt. For the first time direct radio-telephone communication was established with Japan. The U.S.A. gave a simultaneous broadcast from 200 stations, while for the benefit of Australian and New Zealand listeners a gramophone record of the speech was broadcast later.

Northern Ireland.—AUTOMATIC TELEPHONY.—In this area of 5,237 sq. miles, there were 178 telephone exchanges in 1932, during which year the number of calls increased by a million to a total of 24,500,000. A new central exchange is being built in Belfast at an approximate cost of £220,000 by the British Government says the *Irish Independent*. When it is completed all exchanges within a radius of five miles are to be "automatised," including six new exchanges. Underground cable work in the Belfast area in connection with the change-over is progressing.

Norway.—NEW BROADCASTING STATION.—As the first step in the reorganisation of the Norwegian broadcasting system, which is being placed under government control from this summer, a new Marconi station of 20-kW power has been ordered for erection at Trondhjem. The transmitter will be designed and built at the Marconi works, Chelmsford.

Poland.—RADIO LICENCE FEES.—The Ministry of Posts and Telegraphs has reduced the broadcast radio receiving licence fee to its original level of three zlotys per month (about 1s. 6d.) by withdrawing the temporary increase of thirty grosz (about 2d.) which was authorised two years ago in order to provide extra revenue for the benefit of the unemployed.

Russia.—RADIO IN SCHOOLS.—According to the "Bulletin" of the Russo-British Chamber of Commerce, a decree of the Council of People's Commissars of the R.S.F.S.R. provides for the equipment during the current year of 18,980 schools with new radio apparatus.

U.S.A.—RADIO WAVELENGTHS.—The Federal Radio Commission has won its first radio test case to reach the Supreme Court. This ruling has confirmed the Commission's authority to grant the Gary, Indiana, broadcasting station unlimited time use of the 560 kilocycle frequency, which has hitherto been assigned to two Chicago stations, without compensating the latter. The decision has far-reaching implications, but *World-Radio* states that the Commission will not embark upon any general redistribution of wavelengths until next year, when new assignments will be made.

Contract Information

When "Contracts Open" are advertised in our "Official Notice" pages the date of the "Electrical Review" containing the advertisement is given in parentheses below

Contracts Open

Angus.—June 21st. County Council. Various works, including electrical installation, at extension of the County Buildings, Forfar. Master of works, Municipal Buildings, Forfar.

Australia.—MELBOURNE.—July 24th. Victorian State Electricity Commission. Porcelain insulators for all voltages. (A.Y. 11834.)*

Belgium.—BRUSSELS.—July 1st. Société du Canal et des Installations Maritimes de Bruxelles, 50, Rue du Canal, Brussels. Six electrically operated capstans at the locks at Capelle-au-Bois, Willebroeck and Wintham. Particulars for sixty francs.

Birtley (Co. DURHAM).—Parish Council. Extension of overhead public lighting line. Mr. F. Ridley, Neville Crescent, Birtley.

Cleethorpes.—June 19th. Electricity Department. L.p. cable. (See this issue.)

Croydon.—June 28th. Electricity Department. Motor-driven circulating water pump. (See this issue.)

Dover.—June 30th. Corporation. Transformer chambers. (June 2nd.)

Dumfries.—June 27th. County Council. 500-kW rotary convertor, transformer and control gear. (June 9th.)

Dundee.—July 4th (extended from June 20th). Transport Department. Electro-thermal storage system for the heating and ventilation of the central transport depôt. (See this issue.)

East Lothian.—June 30th. County Council. Various works, including electric lighting, at housing schemes. County architect, Haddington.

Edinburgh.—June 21st. Corporation. Alterations to old boiler-house and blacksmith's shop at power station, Dewar Place.

Egypt.—CAIRO.—August 3rd. Ministry of the Interior. Overhead and underground electrical networks. (A.Y. 11817.)*

Fife.—June 26th. County Council. Various works, including electrical, at Leuchars housing scheme. Messrs. Maclennan & Cunningham, 1, Gregory Place, St. Andrews.

Glasgow.—June 19th. Corporation. Electrical work at St. Roch's Elementary School extension. Education offices, Bath Street (deposit £1 1s.).

Hipperholme (YORKS).—June 26th. West Riding. Education Committee. Installation of lighting at Hipperholme Grammar School and headmaster's house. Education Officer, County Hall, Wakefield.

Hull.—June 20th. Education Committee. Electric lighting installation at Mersey Street School. Mr. R. C. Moore, director of education, Education Offices, Guildhall, Hull (deposit £2).

Letchworth.—June 26th. Urban District Council. Electrical installation at 235 houses. Surveyor, Council Offices, Broadway Chambers (deposit £3 3s.).

London.—ISLINGTON.—June 20th. Borough Council. New automatic telephone installation or reconditioning existing system at the Town Hall. (June 9th.)

HOLBORN.—June 21st. Borough Council. Automatic traffic control signals in High Holborn and Theobalds Road. Borough engineer.

OFFICE OF WORKS.—June 27th. Electrical accessories. (See this issue.)

New Zealand.—CHRISTCHURCH.—August 8th. Electricity Department. 11,000-V sub-station switchgear. (A.Y. 11841.)*

Nottingham.—June 20th. Electricity Committee. General stores. (June 9th.)

Portugal.—LISBON.—June 24th. Department of Posts, Telegraphs and Telephones. Supply and installation of a short-wave broadcasting station. Administracao Geral dos Correios, Telegrafos e Telefones, 3a, Divisao da Direccao dos Serviços de Exploraçao Electrica.

Reading.—June 19th. Education Committee. Electric lighting installation and fittings at the Alfred Sutton Central School, Wokingham Road. Borough surveyor (deposit £2 2s.).

Rhondda.—June 26th. Two 150-kVA three-phase static transformers. (June 2nd.)

South Africa.—JOHANNESBURG.—July 15th. 2,000 street lamp fittings (open reflector type) and 1,000 spare holders. (G.X. 12651.)*

July 4th. 115-V, 25-W metallic filament traction lamps. (A.Y. 11842.)*

July 17th. South African Railways and Harbours. Electric lamps. (A.Y. 11833.)*

July 14th. Rand Water Board. 950-kW steam turbine-driven alternator set and switchgear. (A.Y. 11835.)*

PRETORIA.—June 30th. Government Supplies Board. Three-element high-frequency oscillograph. (A.Y. 11832.)*

DURBAN.—September 29th. Town Council. Twenty-two double-deck trolley-buses. Messrs. Webster, Steel & Co., 9, St. Helen's Place, Bishopsgate, E.C.3 (deposit £3 3s.).

July 14th. Telephone cables (A.Y. 11844)* and telephone wires and apparatus (A.Y. 11845.)*

Uruguay.—MONTEVIDEO.—State Electricity Works. Fifty-two 6,000-V, 3-phase, 50-cycle distribution transformers. (A.Y. 11821.)*

July 25th. 17,700 single- and three-phase house service meters. (A.Y. 11822.)*

Worcester.—June 12th. Electricity Department. Switchgear (June 2nd.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed

Blackpool.—Electricity Committee. Accepted. Equipping 6,600-V cubicle.—General Electric Co., Ltd. Switchgear for sub-stations.—English Electric Co., Ltd.

Bolton.—Housing Committee. Accepted. Electrical installations at Gibbon Street and Moorfield Estates.—Engineering Service Co.

Bootle.—Highways Committee. Recommended. Battery (£204).—Chloride Electrical Storage Co., Ltd.

Capetown.—Electricity Committee. Accepted. 100 miles of cambric insulated copper wire (£1,095).—G. H. Langler & Co., Ltd. This is at the rate of £10 19s. per mile; the lowest British tender was £17 5s. 7d. per mile. 1,000 electric light poles (£4,666).—Stewarts & Lloyds, Ltd. House service cut-outs (£575).—Siemens Bros. & Co. (British), Ltd.

Carlisle.—Housing Committee. Accepted. Electrical installation at Council houses.—Ellison Bros.; J. W. Queen.

Cheltenham.—Electricity Committee. Accepted. Cables for twelve months.—Hackbridge Cable Co., Ltd.

Dartford.—Electricity Committee. Recommended. Cable (£541).—Hackbridge Cable Co., Ltd.

East Ham.—Electricity Committee. Accepted. Two sub-station kiosks for Brampton Park and Arragon Road (£181 each).—Crompton Parkinson, Ltd. Two sets of ring-main switchgear.—Switchgear & Cowans, Ltd.

Farnworth.—Urban District Council. Accepted. 300-kW mercury arc rectifier for traction purposes.—Bruce Peebles & Co., Ltd.

Gillingham.—Electricity Committee. Recommended. Transformers (£1,740).—Hackbridge Electric Construction Co., Ltd. Cables (£1,971).—W. T. Henley's Telegraph Works Co., Ltd.

Glasgow.—Electricity Committee. Accepted. Annual supplies: L.p. cable.—Callender's Cable and Construction Co., Ltd.; Enfield Cable Works, Ltd.; W. T. Glover & Co., Ltd.; Metropolitan Electric Cable and Construction Co., Ltd. 6,500-V cable.—W. T. Glover & Co., Ltd. Telephone cable.—Callender's. Rubber insulated cable and flexibles—Craigpark Electric Cable Co., Ltd. D.c. meters—Chamberlain & Hookham, Ltd.; Ferranti, Ltd.; Metropolitan-Vickers Electrical Co., Ltd. A.c. meters—Chamberlain & Hookham, Ltd.; Edison Swan Electric Co., Ltd.; Ferranti, Ltd.; Metropolitan-Vickers. Cast iron boxes, section pillars, &c.—Carron Company; Falkirk Iron Co., Ltd.; Lion Foundry Co., Ltd.; McCallum & Hope, Ltd.; McDowall; Steven & Co., Ltd.; H. A. Mcqueen & Co., Ltd.; Mitchell, Russell & Co., Ltd.; Shaw (Glasgow), Ltd. Cable-covering tiles—J. and R. Howie, Ltd.; Robert B. Whyte.

Liverpool.—Electric Power and Lighting Committee. Accepted. Voltage regulators and isolating switches for the Garston sub-station (£3,217) and the Marsh Lane sub-station (£2,983).—C. A. Parsons & Co., Ltd. Switchgear for static sub-stations during the two years ending June 30th, 1935.—Ferguson, Pailin, Ltd. (high pressure); Metropolitan-Vickers Electrical Co., Ltd. (low pressure). Cables, compounds and tapes for street mains up to March 31st, 1934.—British Insulated Cables Ltd. (one item); Callender's Cable and Construction Co., Ltd. (eleven items).

Peterborough.—Town Council. Electric lighting fittings for the new Town Hall and Municipal offices (£2,984).—C. Harvey & Co. Electric clocks (£62).—Synchronome Co., Ltd.

Portsmouth.—Electricity Committee. Accepted. Cables.—Edison Swan Cables, Ltd. (£2,667); General Cable Manufacturing Co., Ltd. (£40); General Electric Co., Ltd. (£22); Hackbridge Cable Co., Ltd. (£282); Johnson & Phillips, Ltd. (£2,591).

Rotherham.—Transport Committee. Accepted. Motor and controller for electric vehicle (£239).—Ransomes, Sims & Jefferies, Ltd.

Scarborough.—Town Council. Accepted. Switchgear for sub-stations.—English Electric Co., Ltd. (£1,525); Metropolitan-Vickers Electrical Co., Ltd. (£974).

Southport.—Estates Committee. Recommended. Installation of electric lift at offices in Eastbank Street (£416).—Herbert Morris, Ltd.

Swindon.—Highways Committee. Accepted. Automatic traffic control signals (£846).—Automatic Electric Co., Ltd.

Wilts.—County Council. Accepted. Electrical plant for the Pewsey Mental Defective Colony (£1,466).—James Bros. (Trowbridge).

Winchester.—City Council. Accepted. Transformers in connection with the change-over.—English Electric Co., Ltd.

Forthcoming Events

Conference Internationale des Grandes Réseaux Electrique.—June 16th-24th. Paris.

Institution of Heating & Ventilating Engineers.—June 19th-21st. Llandudno. Summer meeting.

Municipal Tramways and Transport Association.—June 20th-23rd. Blackpool. Annual conference.

Institution of Electrical Engineers.—June 22nd. Natural History Museum, S.W. 8.30 p.m. Conversazione. (*South Midland Students' Section*).—June 17th. Summer outing to B.B.C. Daventry. (*North Midland Centre*).—June 24th and 25th. Buxton. Summer outing.

Association of Mining Electrical Engineers.—June 26th-30th. Blackpool. Annual convention.

World Power Conference.—June 28th-July 4th. Stockholm.

Electrical Contractors' Association.—July 5th-7th. Torquay. Annual conference.

Financial Section

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Changes, Transactions in Stocks and Shares

New Companies Registered

Electro-Medical Lamps and Neon Rays, Ltd.—Private company. Registered June 2nd. Capital, £1,000 in £1 shares. Objects: To carry on the business of mechanical, electrical, research and experimental engineers, patentees, manufacturers of medical and dental lamps and other electrical and mechanical appliances, &c., and to acquire the business carried on at 34, Warner Road, Hornsey, as R. P. Myers, including patents, rights, &c. The directors are: A. Burrell, Jnr., 54, Lavender Sweep, Battersea, S.W.11; R. P. Myers, 34, Warner Road, Hornsey, N.8; and A. Lenygar, 23a, Theatre Street, Battersea, S.W.11. Secretary: R. Harrison-Newby. Registered office: 66, Priory Road, Hornsey, N.8.

Hazelpat, Ltd.—Private company. Registered June 8th. Capital, £3,000 in £10 shares. Objects: To carry on the business of manufacturers of and wholesale and retail dealers in radio transmitting and receiving sets, accessories and installations, gramophones, &c. The directors are: H. W. McAteer, Grosvenor House, Park Lane, W.1 (director of Philco Radio & Television Corporation of Great Britain, Ltd.); G. Campbell, Ingelborough, The Ridgeway, Enfield (chairman of Majestic Electric Co., Ltd.); and J. R. Binns, 42, Broadway, New York, U.S.A (director of Hazeltine Corporation of America). Registered office: Jamaica Buildings, St. Michael's Alley, Cornhill, E.C.

Mount Radio, Ltd.—Private company. Registered June 8th. Capital, £500 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in apparatus for receiving and transmitting electricity and conveying energy, sound or vision, radio apparatus, &c. The subscribers (each with one share are: A. C. Glennerster, 24, Souberie Avenue, Letchworth; and M. A. Whayman, 5, Oakhill Road, Surbiton. Secretary: A. C. Glennerster. Registered office: 238, Chingford Mount Road, South Chingford, E.4.

Preston Radio and Electrical Supply Co., Ltd.—Private company. Registered June 2nd. Capital, £5,000 in £1 shares. Objects: To acquire the business of a radio and electrical appliance dealer carried on by Wm. Sugden at 29, Church Street, Accrington. The permanent directors are: W. Sugden, 7, Fairfield Road, Nelson; G. A. Mitchell, "Oakwood," Cross Cop, Morecambe and Heysham; and W. Wilson, 5, Hazelmere Road, Ashton-on-Ribble, Preston. Secretary: Geo. A. Mitchell. Registered office: 19, Winckley Square, Preston.

Neon Portable Signs, Ltd.—Private company. Registered June 10th. Capital, £100 in £1 shares. Objects: To carry on business as manufacturers, producers and assemblers of batteries and other parts and accessories relating to illuminated and other signs, &c. The first directors are: N. Moss, 29, Shoot-up-Hill, N.W.2; H. N. Moss, Manor Vane, Station Road, Thames Ditton; and A. E. Moss, Green Trees, Queen's Drive, Thames Ditton. Secretary: Wm. Talbot. Registered office: 845-850, Salisbury House, London Wall, E.C.2.

Thomasson & Co. (Shrewsbury), Ltd.—Private company. Registered June 8th. Capital, £1,000 in £1 shares. Objects: To acquire the business of electricians and radio dealers carried on by W. Thomasson & Co. at 45, High Street, Shrewsbury, and to adopt an agreement with C. G. G. C. Ralston. The directors are: C. G. G. C. Ralston, 13, St. John's Hill, Shrewsbury; and H. M. Hughes, Highbury, Havelock Road, Shrewsbury. Secretary: O. J. Richards. Solicitor: H. M. Hughes.

Grafton Radio, Ltd.—Private company. Registered June 8th. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers, installers, repairers and maintainers of all radio apparatus, gramophones, &c. The directors are: A. R. Narramore, 84, Castelnau, Barnes, S.W.; and C. P. Hall, 64, Palmers Avenue, North Cheam, Surrey. Secretary: L. R. Baillie. Registered office: 79, Lots Road, Chelsea, S.W.10.

Bluebird Electric, Ltd.—Private company. Registered June 9th. Capital, £100 in 1s. shares. Objects: To carry on the business of electricians, manufacturers of generators, accumulators, &c. The subscribers are: B. J. Hutchby, Bilterley, Ravenstone, Leicester; and L. F. Elverstone, Temple Chambers, Coalville. Secretary: L. F. Elverstone, Temple Chambers, Coalville, Leics.

Crannage Radio, Ltd.—Private company. Registered June 10th. Capital, £2,000 in £1 shares. Objects: To acquire the business of a radio engineer carried on by Gordon Crannage at Uckfield, Rotherfield, and surrounding districts, &c. The directors are: G. Crannage, Trelawn, Loxfield Terrace, Uckfield; H. Wickham, Yew Tree Cottage, Blackboys, Sussex; and J. F. Mitchell, 40, Alexandra Road, Uckfield. Registered office: 114, High Street, Uckfield, Sussex.

Newcastle Electric Clock Co., Ltd.—Private company. Registered June 7th. Capital, £500 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in electric clocks, electrical equipment, &c. The subscribers are: D. G. Cochrane, 6, Gowan Terrace, Newcastle-on-Tyne; and Lena Slater, 16, Kenilworth Road, Newcastle-on-Tyne. Registered office: 52, Sandhill, Newcastle-on-Tyne.

Northern Electrical Wholesalers, Ltd.—Private company. Registered June 6th. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers and repairers of and dealers in electric lamps, domestic appliances, &c. The provisional directors are: J. W. E. Rutherford, 11, Westoe Parade, South Shields, Co. Durham; and J. A. Stobert, 39, Ashley Road, South Shields. Secretary: J. W. E. Rutherford.

British Crystalite Co., Ltd.—Private company. Registered June 7th. Capital, £100 in £1 shares. Objects: To acquire the business of the British Crystalite Co., now carried on at 16, Northumberland Avenue, London, as dealers in electrical goods of all kinds, &c. The directors are: Mrs. Esther Epstein, 4, Cleve Road, N.W.6; J. E. D. Cohan, 22, Denehurst Gardens, Hendon, N.W.4, and two others.

Returns of Electrical Companies

Criterion Radio Products, Ltd.—Capital, £2,000 in £1 shares. Return dated December 1st, 1932 (filed March 20th, 1933). 800 shares taken up. £800 paid. Mortgages and charges registered: Series of debentures for £100 authorised and all issued May 13th, 1933.

Supra Electra Motors, Ltd.—Particulars filed of £5,000 debentures authorised May 12th, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £2,600.

Thames Valley Radio Service, Ltd.—F. A. Bemmer, 29, King William Street, E.C., was appointed receiver and manager on May 23rd under powers contained in debenture dated April 22nd, 1933.

Broadcast Relay Service, Ltd.—The nominal capital has been increased by the addition of £50,000 beyond the registered capital of £50,000. The additional capital is divided into 1,000,000 ordinary shares of 1s. Each of the existing 50,000 shares of £1 has been sub-divided into twenty ordinary shares of 1s.

Electric Rollers, Ltd.—Capital, £500 in £1 shares. Return dated February 7th, 1933. All shares taken up. £500 paid. Mortgages and charges, nil.

Albion Shades, Ltd.—Issue on May 23rd of £100 debentures, part of a series already registered.

Turnadge and Partners, Ltd.—Debenture dated May 30th to secure £436, charged on the company's property, present and future, including uncalled capital. Holder: G. M. Foster, 97, Addison Gardens, West Kensington, W.14.

Stratford-on-Avon Electricity Co., Ltd.—The nominal capital has been increased by the addition of £45,000 in £1 ordinary shares beyond the registered capital of £15,000.

Walsall Electrical Co., Ltd.—The nominal capital has been increased by the addition of £1,000 beyond the registered capital of £2,500. The additional capital is divided into 1,000 non-redeemable preference shares of £1 each.

Milton and Barton-on-Sea (Hants) Electricity Supply Co., Ltd.—The nominal capital has been increased by the addition of £10,000 in £1 shares beyond the registered capital of £15,000.

S. Landau & Sons (Radio), Ltd.—Debenture dated May 15th, to secure £2,500, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: Mrs. S. Landau, 300, Harrow Road, W.9.

Violite, Ltd.—J. R. Pullan, 49, Marlborough Hill, St. John's Wood, N.W., was appointed receiver and manager on May 31st under powers contained in debenture dated May 12th, 1933.

Electra (Birmingham), Ltd.—The nominal capital has been increased by the addition of £500 beyond the registered capital of £1,000. The additional capital is divided into 20 6 per cent. redeemable cumulative preference shares of £25 each.

City Notes

The Brush Electrical Engineering Co., Ltd., held its annual meeting on June 12th, Lord Vaux of Harrowden (chairman) presiding. In presenting the report and accounts (ELEC. REV., June 9th, p. 833), the chairman said that trading conditions had been increasingly difficult during the year under review. The severe reduction in the volume of business suitable for the company's plant caused a steady fall in the price levels, so that the margins to carry to the profit and loss account had fallen at a much greater rate than the actual turnover. In earlier times the company suffered from having too many developments in hand, many of which proved unremunerative. The policy of fully exploiting a few well-established lines resulted in regular dividends over a number of years, but this policy had intensified their difficulties during the present depression in that it was precisely those productions on which they had specialised that were most affected by the present conditions, and the absence of auxiliary productions had made it more difficult to develop new manufactures, particularly as much of their equipment was best suited to heavy work. Economies had been effected in many directions and it had been necessary to discharge a number of the staff, while the remainder had accepted a further reduction of salaries. The period covered what had been one of the most difficult years yet encountered by the company. On all sides there had been rigid retrenchment and limitation of expenditure. This shrinkage of business available had depleted manufacturers' order books and aggravated the already keen rivalry between them, resulting in an uneconomic level of prices. The demand for turbo-generator sets had been extremely low. The order received from the Malta Government was of interest as representing the fourth Brush-Ljungstrom plant to be installed at Valletta. The transformer department had maintained its share of the business available, but this represented a reduction on the turnover of the last few years. The production of kiosks recently embarked upon had made favourable progress. The redesigning of their a.c. motors was resulting in increased turnover.

The Salter Report had had an unfortunate effect upon the rolling stock business during the latter portion of the year, and there had been a serious reduction in the total demand for motor omnibuses. They had produced a motor-bus body of all-metal construction, and in addition had a single-deck trolley-bus under demonstration at Bournemouth. A double-deck trolley-bus had been ordered by the Derby Corporation, and they believed that there was a considerable future for this type of passenger transport. Consideration had been given to the manufacture of new lines of products suitable to the company's plant. These in most instances had previously been

manufactured abroad. Some of them had been found unacceptable, but in other cases favourable progress had been made, and work was in hand which they hoped would have important developments.

Edmundsons Electricity Corporation, Ltd., intends in future to publish each month the total number of kWh generated and purchased in bulk for distribution, indicating the increase or decrease as compared with the corresponding month of the previous year. Below are given figures relating to the first five months of 1933, compared with the corresponding period of last year :—

January-May.	1933. kWh.	Increase as compared with 1932. Actual. kWh.	Per cent.
January	44,346,000	8,525,000	+24
February	38,625,000	4,370,000	+13
March	39,254,000	6,079,000	+18
April	33,556,000	2,067,000	+ 7
May	36,949,000	8,039,000	+28
Total for five months	192,730,000	29,080,000	+18

The Electric Furnace Co., Ltd., reports a net profit for the year ended March 31st last of £5,920, as compared with £9,306 in the preceding year. To this is added £1,154 brought in making £7,075, and it is proposed to pay a final dividend of 3½ per cent. on the cumulative preferred ordinary shares, making 7 per cent. for the year, leaving £1,389 to be carried forward. The report states that remarkable progress was made by the Electric Resistance Furnace Co., Ltd., all the shares of which are held by the Electric Furnace Co. The total value of orders received last year by the company and its subsidiary together constitutes a record in their history, and much of this work is being carried over into the current year. Important installations have been undertaken at home and in Sweden, Belgium, France, Russia, India and South Africa. There was an important increase in orders from British works, which have resulted from the improvement in the British iron and steel trades. Arrangements for technical co-operation with British and Continental firms have been extended with good prospects of a broadening of the company's activities. Meeting : June 19th.

Telephone Rentals, Ltd., held its annual meeting on June 12th, when Mr. F. T. Jackson (chairman), who presided, said that the total depreciation and other reserves in the accounts of the British and Australian subsidiaries amounted to over £394,000. The Australian reserve was £35,400, and was included in the total at the par rate of exchange. During the year the rental revenue had been increased by 4 per cent. on the 1931 rentals, which was the same percentage increase as that made last year, but it was on a larger total revenue than the previous year. The sales development campaign was continued throughout the year with satisfactory results when viewed in the light of general trade conditions. During 1933 up to date this campaign had proved of very great value, as the results, measured in terms of new contracts, for February, March, April and May, were 41.2 per cent. in excess of those received in the corresponding months last year. It was of particular interest to note that the subsidiary companies which had been making the greatest headway were those situated in areas which had come to be regarded as the most depressed in this country from the industrial point of view.

The Madras Electric Supply Corporation, Ltd., held its annual general meeting on June 7th, Mr. James Gray presiding in the absence of Mr. John G. B. Stone (chairman of the company). Moving the adoption of the report and accounts (mentioned in our issue of June 2nd, page 797), Mr. Gray said that there was evidence of continued progress, the generation of electricity having increased by 20.3 per cent. and the sales by 23.4 per cent. over 1931. Of the energy sold, lighting and fans represented 21.6 per cent., street lighting 5.9 per cent., and power 72.5 per cent.; the last-named showed an increase of 36.5 per cent. The improved traffic returns from the tramway were maintained, receipts and passengers carried having increased by 4.2 and 4.9 per cent. respectively. On July 1st a revised scale of electricity charges would come into operation, and the company must be prepared for a reduction in revenue during the latter half of 1933; however, to provide for this a larger amount than usual had been carried forward and, furthermore, an increase in the demand for power supplies was reported.

The London & Suburban Traction Co., Ltd., has issued to its debenture holders particulars of the scheme for allocating the London Transport stock to be given in exchange for the company's undertaking which is being acquired by the London Passenger Transport Board. The company's subsidiaries, the Metropolitan Electric Tramways, Ltd., the London United Tramways, Ltd., the Tramways (M.E.T.) Omnibus Co., and the South Metropolitan Electric Tramways & Lighting Co., Ltd., will be wound up and the transport stocks to which these companies will be entitled under the London Passenger Transport Act will be issued to their debenture holders. Meetings of the preference and ordinary shareholders will be held on June 30th at 55, Broadway, S.W.1.

Hick, Hargreaves & Co., Ltd., report a profit for the year ended March 31st last of £645, as compared with £4,673 in the preceding year. After providing for depreciation, debenture interest and income tax, there is a net loss of £4,409, which is reduced to £1,995 by a credit balance of £2,414 brought in. This is met by £4,000 transferred from reserve, leaving £2,005 to be carried forward. The report states that the deplorable state of trade both at home and abroad, has made it impossible to keep the works employed at even half their capacity, and the work obtainable has been secured at highly competitive and unremunerative prices. The current year marks the centenary of the Company.

Guest, Keen & Nettlefolds, Ltd., held their annual general meeting on June 8th. The report and accounts were reviewed in our issue of June 2nd (page 797). Referring to the bad state of trade, Sir John Field Beale, chairman and managing director, said that although the second preference dividends were now two years in arrears, the financial position and structure of the company were very strong, and, if the arrears did not materially increase before the tide of trade turned, they should not hamper the company's progress. The company was to be congratulated on having come through the crisis with its strength unimpaired and its position unshaken. All the three larger subsidiary companies were not only in a sound position but were better situated than a year ago.

The Barcelona Traction, Light & Power Co., Ltd., reports a revenue for 1932 of $2,943,319 (Canadian), as compared with $3,228,074 in 1931. To this is added $1,099,722 brought in, making $4,043,041, and after meeting expenses and the service on bonds and placing $400,000 to reserve, there is a balance of $2,010,014, which is carried forward. The directors state that owing to the uncertainty of exchange, labour difficulties, increased taxation and the general world unrest, they consider it unwise to deplete the company's resources by paying a dividend at the present time. A dividend of 50 cents per share was paid for 1931.

The Nigerian Electricity Supply Corporation, Ltd., reports a profit of £19,521 (against £25,227) for the year ended February 28th last. To this is added £1,816 carried forward from the previous year, making £21,337, and it is proposed to write off £99,693 cost of concession, £36,804 depreciation of plant, and £34,505 the balance of preliminary expenses. There is thus a net loss of £149,664, which it is proposed to eliminate by writing down the ordinary capital from £200,000 to £50,000, to which arrangement the shareholders have already agreed. Meeting: June 29th at Winchester House, E.C.

Ward & Goldstone, Ltd., report a net profit of £14,112 for the year ended March 31st last after providing for depreciation and income tax; this was an advance of £4,174 on the preceding year's figure. A sum of £18,536 was brought forward, making £32,648 available. A final dividend of 7 per cent. (same) is to be paid on the ordinary shares (absorbing £3,308) and £2,000 is to be placed to income-tax reserve; £23,140 is carried forward. It is stated that the turnover and output have been well maintained and over £17,000 was spent during the past year on works extensions, plant and tools. Meeting: June 21st.

Mirrlees, Bickerton & Day, Ltd., record a net profit of £12,679 for the year ended March 31st last (against £7,289 in 1931-32), plus £8,945 brought in. Dividends on the preference shares absorb £2,928, and a distribution of 3 per cent. (against 2½ per cent.) is made on the ordinary capital, leaving £8,210 to be carried forward. Meeting: June 27th.

The Central Electricity Board.—It is reported that the underwriters to the recent issue of £8,000,000 3½ per cent. stock will have to take up 58.2 per cent. of their commitments.

The Canadian General Electric Co. has declared a quarterly dividend of 75 cents per share on the common stock (against $1).

The Tellus Super Vacuum Cleaner Co. reports a net loss for 1932 of £6,852, as against £4,368 in 1931, which with a debit of £6,961, brought in, makes a total deficit of £13,813.

Stocks and Shares

TUESDAY EVENING.

THE proceedings of the World Economic Conference are being watched with close attention by everyone interested in money matters, even though, from the practical point of view, the Conference is not, and has not been, expected to afford productive results of any great magnitude. A large body of opinion continues to argue that until a sound means is provided for dealing with war debts, no improvement of real consequence can be looked for. On the other hand, the Conference may possibly do something in the direction of stabilisation of currencies, and by this means enable resumption of trade relations between countries which are at present struggling under very difficult circumstances, to do business with one another. That improvement in this direction is possible can be seen by the relief afforded to Anglo-Argentine industry through the agreement recently reached, the effect of which is already reflected in advances that have taken place in various Argentine securities. Amongst these are included such industrials as the Anglo-Argentine Tramways Company, whose shares and stocks have risen appreciably during the past fortnight. The 5 per cent. debenture stock at 14½ compares with 10 about a month ago, the second preferences have gone up from 1s. 9d. to 5s., and the first preferences, instead of being unsaleable at 2s. 6d., now stand at 6s. 3d.

New Central Electricity Stock

The large issue of £8,000,000 in 3½ per cent. stock offered by the Central Electricity Board at 93½ was left in the hands of the underwriters to the extent of 58 per cent. Had the offer been made, say, a month ago, the stock would probably have been snapped up eagerly, but monetary conditions have changed to some extent owing to the uncertainties surrounding South African affairs and the American position, with the result that public subscription to the Central Electricity issue came to a little under 3½ million pounds. In consequence, the price stands about 1½ discount. Underwriting commission was 1 per cent., so that at the figure mentioned the underwriters can get out, if they wish to do so, at a modest profit. The other issues of the Central Electricity Board are unaffected by this result.

Gilt-edged Stocks and Shares

We have no compunction in regarding the ordinary shares of the London electricity supply companies as being fit for inclusion amongst any list of gilt-edged shares. This may

appear unorthodox in the eyes of such investment as that which looks at anything outside the trustee list as being risky. The ordinary shares of the principal companies, however, now stand in a position which entitles them to be deemed the best which the industrial list can afford. It might well have been supposed, having regard to the present tendency amongst gilt-edged stocks, where prices are inclined to react by reason of the greater attention paid to industrials, that the electricity quotations would have responded to this disposition. In point of fact, however, the shares are so tightly held that their prices have been, so far, exempt from the dullness which has attacked British Government and "safety first" securities. In the provincial list, a slight easing-off is noticeable, Midland Electric Power, for instance, being 1s. down at 37s. 6d., Electric Distribution of Yorkshire 9d. lower at 45s. There is, it may be useful to mention, a parcel of 10,000 Lancashire Electric Light and Power ordinary shares on offer at 31s. 6d., yielding £4 8s. 9d. per cent. on the basis of the last-paid dividend of 7 per cent. for the year.

Ordinary Shares on Offer

Amongst other lines of shares available, 5,000 Edmundson's ordinary can be bought at 33s. 3d., ex the recently paid dividend, free of stamp and fee, the yield being £4 4s. per cent., and 5,000 London Electric Supply Corporation at 32s. 3d., to give £4 6s. 9d. per cent. A couple of thousand ordinary shares in Southern Areas Electric Corporation can be bought at 24s. 9d., to give £4 8s. 9d. per cent., assuming a dividend of 5½ per cent., which the directors propose to pay for the year ended December 31st, 1933, provided nothing unforeseen occurs. Moderate amounts of ordinary shares can be obtained in the Scottish Power, North Eastern, Newcastle-on-Tyne Electric, and Electrical Distribution of Yorkshire companies, upon the basis of the prices mentioned in our lists, where, also, the yields are set out calculated upon the distributions made in respect of 1932.

Dollar Stocks

Prices of dollar stocks have been jumping up and down with the same vivacity as was shown last week-end by the mercury in the thermometer. New York is recovering its optimism; money is accumulating in the States, and its possessors—incurable speculators as the Americans are—seem quite willing to employ the cash in the purchase of utility and industrial stocks and shares. A marked difference is made between the two sections, utility and industrial, the former being confined more particularly to companies dealing with electricity, lighting, power and similar public services, the group of industrials comprising everything else relating to trade. American Telephone & Telegraphs went back 5 to 147½ after the spectacular rise of the past fortnight: then sprinted to 157½. International Telephone & Telegraphs, which were down to 7¾ not so very long ago, have been 25, and are now 24. Incidentally, it may be added that the price last year at one time touched 4. Consolidated Gas & Electric of Baltimore, another popular share, is up a couple of dollars to 77. Amongst Canadians, a two-point rise lifted Shawinigans to 19½. Power Corporation of Canada are unchanged at 16. There is a lively speculation afoot in Hydro-Electrics, and the present price of 10½ is more than double that which obtained earlier in the year.

The Mexican group is very steady, and Brazilian Tractions jumped 3, to 19. Mexico Tramway fifty-year bonds at 23½ also show a gain of 3 points.

Miscellaneous Matters

The fortunate folks who bought British Electric Traction deferred ordinary stock at 275 at the end of last month must be feeling very pleased to see the price up to 425, the present quotation. The latter shows a gain of 110 points on the week, demand having been stimulated by the dividend and the bonus issue. The company's 8 per cent. preferred ordinary at 135 is a point to the good. London and Suburban Traction 5 per cent. preference have advanced to 19s., showing a gain of 1s. 6d. on account of the expectation that dealings in the new London Passenger Transport stocks will start early next month. It was hoped that everything would be ready for the market to open in these stocks on July 1st, but unavoidable delay may occur, though this is not likely to last for more than a few days. The erratic movements of South African mining shares is reflected in a decline to 83s. 9d. in Victoria Falls ordinary. The iron and steel market is tolerably steady, Vickers, however, being a dull spot at 6s. 3d. Babcock & Wilcox remain at 34s. 6d. The exuberance of rubber proved to be short-lived, with a fall in the price of the raw material. Share values have also declined, and the speculative interest, which a week ago was very animated, has subsided to a more normal level.

Manufacturing and Equipment

The excellence of the results achieved by Callender's as shown by the recently issued report are responsible for a rise to 3 in the ordinary shares. Henleys are ⅛ harder at 6½, on the impression that the forthcoming report will make pleasant reading for the shareholders. British Aluminium at 28s. 3d. have gained 9d., and Crompton Parkinson preference at 31s. 3d. are ⅛ up. Ever-Readys are a dull spot at 26s. 9d. ex dividend. Electric Constructions at 12s. 6d. are 2s. 6d. better.

Share List of Electrical Companies

	Nom.	Approx. Dividend. 1931.	1932.	Price, June 13.	Rise or Fall.	Yield. p.c. £ s. d.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	1	15	15	73/9	—	4 1 4
Brompton Ordinary	1	8½	7	32/6	—	4 6 2
Central Electricity 4½% Deb.	Stock	4½	4½	105xd.	—	4 5 9
Charing Cross Ordinary	1	8d	7	33/6	—	4 3 7
Chelsea	1	8½	7	32/6	—	4 6 2
City of London	1	10	10	33/6	—	4 3 7
Clyde Valley	1	7	7	35/-	—	4 0 0
County of London	1	10½	10½	53/3	—	3 19 2
Edmundsons' 7% Pref.	1	7	7	30/6	—	4 11 10
Elec. Dis. Yorkshire	1	9	9	45/-	−9d.	4 0 0
Elec. Supply Corporation	1	11	11	64/6	−¼	3 8 4
Kensington Ordinary	1	8	7	33/-	—	4 4 10
Lancs Light and Power	1	7	7	31/3	—	4 9 7
London & Home Counties 4½% Deb.	Stock	4½	4½	109	—	4 3 4
London Electric	1	9	7	32/6	—	4 6 2
Metropolitan	1	10	10	50/-	−9d.	4 0 0
Midland Counties	1	7	7	35/-	—	4 0 0
Mid. Elec. Power	1	8	8	37/6	−9d.	4 5 4
North Eastern Electric Ordinary	1	6	6	30/-	—	4 0 0
Do. 7% Pref.	1	7	7	32/-	−6d.	4 7 6
Northampton	1	10	10	50/-	—	4 0 0
Notting Hill 6% Pref.	10	6	6	13½	—	4 10 7
North Met. Elec. 6% Pref.	1	6	6	29/-	−6d.	4 2 9
St. James' and Pall Mall	1	8	7	32/6	—	4 6 2
Scottish Power	1	8	8	36/3	—	4 8 2
South London	1	8½	7	33/-	—	4 4 10
Urban Ordinary	1	7	7	37/6	—	3 14 8
Westminster Ordinary	1	8½	7	32/6	—	4 6 2
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	18/9	—	8 0 0
Yorkshire Elec.	1	8	8	46/3	—	3 14 3
HOME RAILS.						
Central London Ord. Assented	Stock	4	4	87½	—	4 11 5
Metropolitan	„	2½	1⅛	72	—	2 5 2
Do. Distict	„	4½	3	69½	+1	4 6 4
Underground Electric	1	7	4½	21/6	+6d.	4 3 9
TELEGRAPH AND TELEPHONES.						
American Tel. & Tel.	$100	9	9	157½	+5	5 14 3
Anglo-Am. Tel. Pref.	Stock	6	6	105½	—	5 13 10
Do. Def.	„	1½	1½	23½	—	6 7 8
Cables & Wireless 5½% Pref.	„	2¾	2¾	74¼xd.	—	3 13 10
Do. A 7½% Ord.	„	—	Nil	26	—	—
Do. B Ord.	„	—	Nil	12½	+1⅛	—
Globe Tel. and T. Ord.	10	Nil	2½	10½	+½	2 8 9
Do. do. Pref.	10	6	6	11⅝	+⅛	5 3 4
Great Northern Tel.	10	20	20	28	—	7 2 10
Marconi-Marine	1	10	7½	31/3	—	4 16 0
Oriental Telephone Ord.	1	12	12	24½	—	*4 1 8
HOME AND FOREIGN TRAMS, ETC.						
Anglo-Arg. Trams First Pref.	5	—	—	7/-	+2/-	—
Do. do. 2nd Pref.	5	—	—	5/-	+3/3	—
Do. do. 5% Deb.	Stock	—	—	14½	+2	—
British Electric Traction Def. Ord.	„	5	5	425	+110	—
Do. do. Pref. Ord.	„	8	8	135	+1	5 18 5
Brazil Traction	100	—	—	19	+3	—
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	102½	—	4 19 6
London & Sub. Trac. 5% Pref.	1	Nil	Nil	19/-	+1/6	—
London United Tram Deb.	Stock	4	4	75½	—	5 6 0
Mexico Trams. 5% Bonds	—	5	5	36½	—	13 14 0
Mexican Light Common	100	Nil	Nil	14½	—	—
Do. 7% Pref.	100	7	7	15	—	—
Do. 1st Bonds	—	5	5	64½	—	7 15 6
Victoria Falls Ord.	1	15	15	83/9	—⅛	3 11 9
Yorkshire (West Riding)	1	Nil	Nil	9/-	—	—
MANUFACTURING COMPANIES.						
Assoc. Elec. Ord.	1	4	4	17/6	—	4 11 5
Do. Pref.	1	8	8	28/3	—	5 13 3
Babcock & Wilcox	1	14	9	34/6	—	5 4 4
British Aluminium Ord.	1	5	5	28/3	+9d.	3 10 10
British Insulated Ord.	1	15	15	67/6	—	4 9 3
Brush Ord.	Stock	Nil	Nil	35	−5	—
Callender's	1	15	15	3	+⅛	5 0 0
Do. 6½% Pref.	1	6½	6½	28/9	—	4 10 5
Crompton Parkinson Ord.	5/-	22½	—	17/6	—	6 8 7
Do. 8% Pref.	1	8	8	31/3	+⅛	5 2 5
Edison-Swan 1st Pref.	1	7½	7½	24/6	—	6 2 5
Do. 5% Deb.	Stock	5	5	102½	—	4 17 7
Electric Construction	1	Nil	Nil	12/6	+⅛	—
Enfield Cable Ord.	1	25	25	4½	—	5 11 1
English Electric	1	Nil	Nil	7/6	—	—
Do. do. Pref.	1	Nil	Nil	12/6	—	—
Ever Ready	5/-	35	35	26/9xd.	—1/-	6 10 10
Ferranti Pref.	1	7	7	24/3	—	5 15 6
G.E.C. Pref.	1	6½	6½	29/9	—	4 7 5
Do. Ord.	1	8	—	43/3	—	3 14 3
Henley's	1	30	—	6½	+⅛	4 15 10
Do. 4½% Pref.	5	4½	4½	5½	—	4 5 9
India-Rubber	1	Nil	Nil	2/6	—	—
Johnson & Phillips	1	5	5	18/3	—	5 9 7
Siemens Ord.	1	7½	6½	24/6	—	5 6 0
Telegraph Construction	£1	Nil	Nil	18/3	—	—

* Dividends paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken.

1931.

23578. "Thermionic valves." W. R. Bullimore. August 21st, 1931. (392591.)
27829. "Electric motor starting and like gear." Brookhirst Switchgear, Ltd., J. A. Hirst, and C. Lanceley. October 7th, 1931. (Cognate application 27830/31.) (392546.)
28965. "Portable electric battery lamps." J. Wilczynski. October 18th, 1930. (392595.)
29141. "Protective apparatus for electric circuits." British Thomson-Houston Co., Ltd. October 20th, 1930. (Patent of addition not granted.) (392596.)
31179. "Electrical resistances, heaters, and the like." Expanded Metal Co., Ltd., E. T. Williams, and S. W. Melson. November 10th, 1931. (392549.)
31588. "High-frequency electric oscillation generating arrangements." Marconi's Wireless Telegraph Co., Ltd. December 4th, 1930. (392533.)
31589. "Loud speakers, pick-ups, sound-recording, and like devices." H. R. Ronnebeck. November 14th, 1931. (Cognate application 18877/32.) (392573.)
31716. "Electric signs." Claude- General Neon Lights, Ltd., and C. Higgins. November 16th, 1931. (392541.)
31733. "Tuning apparatus for radio receivers." R. F. Collingson. November 16th, 1931. (392543.)
31758. "Attachments for securing electric insulator supports to chimney stacks, pillars, or the like." Bullers, Ltd., and J. G. Miller. November 16th, 1931. (392545.)
31956. "Methods and apparatus for bringing into step two electric oscillations." H. J. J. M. De R. De Bellescize. November 19th, 1930. (392567.)
31982. "Light projectors." General Electric Co., Ltd., and J. M. Waldram. November 18th, 1931. (392607.)
32066. "Electrical sign." H. Roberts. January 7th, 1931. (392608.)
32126. "Cathode-ray apparatus." British Thomson-Houston Co., Ltd. November 19th, 1930. (392583.)
32241. "Electrical control circuits for thermionic rectifiers." Marconi's Wireless Telegraph Co., Ltd., and D. E. O'Donovan. November 20th, 1931. (392611.)
32703. "Electric cables for communication purposes." Siemens Bros. & Co., Ltd., and A. Rosen. November 25th, 1931. (392624.)
32713. "Electric hearing apparatus for the deaf." A. Von Suchorzynski. February 17th, 1931. (392625.)
32724. "Apparatus for the treatment of liquids by ultra-violet-ray light." J. O. Hickman. November 25th, 1931. (Cognate application 4736/32.) (392626.)
33123. "Transformer equipment particularly for use with electron-discharge devices such as X-ray apparatus." W. Watson & Sons, Ltd. February 26th, 1931. (392632.)
35570. "Electrically operated gauge." G. W. Parr and Bircheen Assets, Ltd. December 23rd, 1931. (392646.)

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149. "Traffic-control signals." Chance Bros. & Co., Ltd., and J. H. Abbink-Spaink. January 2nd, 1932. (392650.)
508. "Method of making electrical connections." Siemens Bros. & Co., Ltd., and W. H. Grinsted. January 7th, 1932. (392651.)
2276. "Equipment for light therapy." Siemens & Halske Akt.-Ges. January 24th, 1931. (392666.)
3971. "Electric tumbler switches." R. W. L. A. Ham. February 10th, 1932. (392675.)
3991. "Electric discharge device." General Electric Co., Ltd., and J. T. Randall. February 10th, 1932. (392676.)
4450. "Electric discharge devices." International General Electric Co., Inc. February 14th, 1931. (392678.)
4883. "Means for making connection between electric conductors and terminals or other fittings." W. T. Henley's Telegraph Works Co., Ltd., and W. H. Nichols. February 18th, 1932. (392682.)
7619. "Road traffic control or danger signals." S. Eaton. March 15th, 1932. (392705.)
8493. "Stabilising device for use in thermionic valve circuits." F. G. Woodall. March 22nd, 1932. (392714.)
9749. "Electric contact springs." Ideal Werke Akt.-Ges. für Drahtlose Telephonie. December 24th, 1931. (392721.)
12195. "Simultaneous transmission of different high-frequency signalling currents for television and the like." M. Von Ardenne. April 29th, 1931. (392729.)
12384. "Television apparatus and the like." J. L. Baird and Baird Television, Ltd. April 29th, 1932. (Addition to 322,481.) (392730.)
12595. "Electric vacuum devices." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. August 4th, 1931. (392731.)
13363. "Electrical rectifying plant." Allgemeine Elektricitats-Ges. May 8th, 1931. (Addition to 21797/31.) (392735.)
13412. "Electric indicating fuse." W. Row. May 10th, 1932. (392736.)
16590. "Holder for tubular electric lamps and discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. June 15th, 1931. (392749.)
18261. "Anode protecting grids of metallic vapour rectifiers." Siemens Schuckertwerke Akt.-Ges. September 19th, 1931. (392760.)
18287. "Induction electricity meters and the like." Measurement, Ltd., and F. Holden. June 28th, 1932. (392761.)
18668. "Electric furnaces." British Thomson-Houston Co., Ltd. July 1st, 1931. (392764.)
20321. "Impulse senders of the dial type." J. H. Bell. November 13th, 1931. (Divided application on 31520/31.) (392588.)
22442. "Electro-magnetic vibratory massage apparatus." Soc. Le Moulage Industriel Moderne. August 18th, 1931. (392778.)
22868. "Cathode-ray tubes." Telefunken Ges. für Drahtlose Telegraphie. August 15th, 1931. (392781.)
23141. "Electric lampholders." H. A. Wootton and A. Watson. August 18th, 1932. (392784.)
24529. "Electric discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. December 23rd, 1931. (392796.)
25276. "Mountings for cathode-ray tubes." Radio Corporation of America. September 11th, 1931. (392801.)
27066. "Electric discharge devices." British Thomson-Houston Co., Ltd. September 30th, 1931. (392807.)
27194. "Electro-optical apparatus for receiving and indicating or recording acoustic signals and other sounds." E. Leitz Ges. October 6th, 1931. (392808.)
27383. "Television transmission method." M. Von Ardenne. October 6th, 1931. (392810.)
27434. "Electromagnetically actuated gas compressors." Teves-Maschinen und Armaturen Fabrik Ges. and W. Konig. October 3rd, 1932. (392811.)
28106. "Electric discharge tubes." Elektrische Gluhlampenfabriken J. Kremenezky Akt.-Ges. October 15th, 1931. (392815.)
30090. "Electric battery lamps." R. Bosch Akt.-Ges. January 16th, 1932. (392828.)
30555. "Electron-discharge devices." British Thomson-Houston Co., Ltd. October 29th, 1931. (392833.)
31950. "Multi-cell electrolysers." A. Mentzel. November 11th, 1932. (392838.)
32625. "Radio receivers." Hazeltine Corporation. December 14th, 1931. (392841.)
34589. "Therapeutic appliances for electrical treatment of the body." J. Kellner. December 14th, 1931. (392847.)
34999. "Electric discharge devices." Telefunken Ges für Drahtlose Telegraphie. December 9th, 1931. (392849.)
36691. "Electric clocks." A. L. Jeanneret. December 28th, 1932. (392855.)
37031. "Electric incandescent lamps." British Thomson-Houston Co., Ltd. December 31st, 1931. (392858.)

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94. "Electric secondary or storage batteries." Drumm Battery Co., Ltd., J. J. Drumm, T. Hagyard, and R. H. D. Barklie. December 9th, 1931. (Addition to 365125.) (Divided application on 34178/31.) (392859.)
474. "Electrically heated hot water storage tanks." A. Low & Sons, Ltd., D. W. Low, and R. C. Burton. January 6th, 1933. (392862.)
545. "Means for limiting short-circuit current in alternating-current systems." International General Electric Co., Inc. January 6th, 1932. (392865.)
704. "Thermionic valve circuit arrangements." Telefunken Ges. für Drahtlose Telegraphie. January 9th, 1932. (392866.)
1408. "Television receivers." Marconi's Wireless Telegraph Co., Ltd. January 15th, 1932. (392869.)
5918. "Contacts for electric switches." International General Electric Co., Inc. February 25th, 1932. (392880.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from June 7th :—

Mainud. No. 539750. Class 6. Electric starters for internal-combustion engines.—Mainud Starter, Ltd., 53, New Broad Street, E.C.2.

Rexideal. No 538771. Class 8. Radio receiving sets.—F. F. C. King, 235, Banbury Road, Oxford.

Scarlet Runner. No. 540624. Class 8. Apparatus for displaying registration numbers of motor vehicles by means of light reflective surfaces and/or by means of interior illumination.—Frederick G. Creed, 11, Sydenham Road, Croydon.

Igranicor. No. 541050. Class 8. Electrical coils (not for medical purposes).—Igranic Electric Co., Ltd., 147, Queen Victoria Street, E.C.4.

The Times. No. 539964. Class 13. Electric lamps (ordinary).—B.I.M., Ltd., Roden Street Works, Ilford, Essex.

Metocel. No. 540503. Class 40. Wire insulated with material consisting principally of india-rubber and used for electrical purposes.—Ward & Goldstone, Ltd., 107, Frederick Street, Pendleton, Manchester.

Cibanite and Cibanoid. Nos. 539865 and 539867. Class 50. Compositions prepared from natural and synthetic resin and sold in the form of sheets, bands, slabs, bars, blocks and tubes, and as mouldable powders, electrical insulating materials, &c.—Society of Chemical Industry of Basle. (British representatives: Abel & Imray, 30, Southampton Buildings, Chancery Lane, W.C.)

World Power Conference, 1933

AT this year's Sectional Meeting of the World Power Conference, which is to take place in Scandinavia between June 26th and July 7th, the British Government will be represented by two official delegates: Mr. A. E. L. Chorlton, C.B.E., M.P. (President, I.Mech.E.), who will be head of the British Delegation, and Dr. F. S. Sinnatt, M.B.E. (Director of Fuel Research). The British National Committee has now appointed the following additional official delegates: Sir Andrew Duncan (chairman, C.E.B.), Sir David Milne-Watson (Governor, Gas, Light and Coke Company and President of the National Gas Council), Sir Harold Hartley (vice-president, L.M.S. Railway and chairman of the Fuel Research Board). The committee has also appointed as honorary official delegates: Sir Archibald Page (general manager, C.E.B.), Dr. E. W. Smith, C.B.E. (technical director, the Woodall-Duckham Companies), Mr. Roger T. Smith (past-president, I.E.E.), and Mr. H. E. Mitton (Butterley Co., Ltd.). The total British membership will probably be about sixty, a figure which, in view of present economic conditions, affords strong evidence of widespread appreciation of the value of the Conference.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Aldershot.—Flats (24), Windmill Lane; borough surveyor. Houses (200 to 250); Workmen's Housing Association, Ltd.

Ambleside.—Houses (24); H. Piper, U.D.C. surveyor.

Ashford (KENT).—Houses (£14,929); H. Godden, builder, Ham Street, Orlestone.

Basingstoke.—Shops and office premises, Mortimer Lane; G. W. Oliver & Sons, builders, Flaxfield Drive.

Blackburn.—Engineering works, Witton, for Hindle, Son & Co., Union Engineering Works, Haslingden (electrical installation); Ed. Lewis & Sons, builders, Shorrock Delph. Extensions, Brock Hall Institution, Langho, for Lancashire Hospitals Board (electrical installation); Rees & Holt, architects, 64, Rodney Street, Liverpool.

Bolton.—Houses (60), Ferns Estate, Tudor Avenue; Geo. Le Maire Barnes. Bus station, Deansgate; borough engineer.

Bradford.—Houses (160), Great Horton Road; British Cotton Dyers' Association, Ltd. Houses (41), Ingleby Road; J. Smith. Houses (31), Moore Avenue; H. Crabtree.

Bristol.—Shops, junction of Kingsway and Two Mile Hill; Raymond, Cook & Oarsons.

Bury (LANCS).—Houses (164), Huntley Fold Estate; borough engineer.

Cardiff.—Houses (34), Tremorfa Estate (£6,186); C. Brown & Co.

Castle Douglas.—Cinema for Castle Douglas Theatres, Ltd.; secretary.

Cheltenham.—Houses (49), Alstone Lawn Estate (£13,075); Copp Bros., Ltd. Winter gardens scheme (£150,000); J. R. Wilkins, architect, 4, Magdalen Street, Oxford. Alterations, Little Theatre, Bath Road; Madame Irving.

Clown.—Houses (160), with electrical installations; Oxcroft Colliery Co., Ltd., Shuttlewood, Chesterfield.

Coatbridge.—Reconstruction of premises for the Co-operative Society (£4,000); manager.

Darlington.—Houses (50), Boyne Street; borough surveyor. Houses (20), Thompson Street West; J. E. Chilton, architect, Tubwell Row.

Deal.—Houses (96) and flats (56); T. C. Golder, borough surveyor.

Doncaster.—Cinema (£60,000) for the Gaumont British Co.; W. E. Trent, architect, 96, Hermon Hill, London, E.

Dudley.—Flats, Hill Crest Road (£4,219); J. Webb, Coseley.

Durham.—School, Easington, for County E.C.; F. Willey, architect, 34, Old Elvet.

Eccles.—Additions to Godfrey Ermen Memorial School (electrical installation); N. Hartley Hacking, architect, 5, Blackfriars Street, Manchester.

Edinburgh.—Houses (128), Niddrie Mains; city architect.

Gateshead.—Alterations for the Britannic Assurance Co., Ltd., High Street; J. Milne, builder, Coatsworth Road. Remodelling of Redheugh and Rose Street Schools (£2,400); W. Hall, Ltd., builders, Derwentwater Road.

Gillingham.—Houses (22), Beaconsfield Avenue; F. T. Mattocks. Houses (53), Third Avenue; W. G. Wilson. Shops, 151-5, High Street, for Marks & Spencer, Ltd.; A. T. Batzer.

Glasgow.—Houses (28), Carntyne, and extensions, Possilpark School (£10,000); trade contractors.

Goring (SUSSEX).—Development of Goring Hall Estate; Duncan B. Gray & Partners.

Hull.—Shops (16), Southcoates Lane (electrical installation); D. C. Allderidge, architect, 101, Alfred Gelder Street.

Inverness.—Technical school; Master of Works, County E.C.

Irish Free State.—(THURLES, CO. TIPPERARY).—Houses (137); J. M. Kennedy, town clerk.

Isle of Ely.—Senior school, March; R. D. Robson, county architect, March.

Kelso.—Building for Commercial Bank; manager.

Kendal.—Houses (380); borough surveyor.

Kettering.—Extensions, Kettering and District General Hospital, Rothwell Street; Riddall & Sons, builders, Crown Street.

Lewes.—Cinema (electrical and heating work); Rice & Son, Ltd., builders, London and Margate.

Lydney (GLOS).—Holy Trinity Church; A. C. Billings & Sons, Ltd., builders, Cheltenham.

Macclesfield.—Bank premises, Market Place, for Union Bank of Manchester, Ltd., York Street (electrical installation); H. Quentery Farmer, architect, 102, Brock Street.

Maltby.—Houses (120), Grange Lane, Woodlands Estate; M. R. Jones, U.D.C. surveyor.

Manchester.—Houses (100), Stansfield Street, Newton Heath; Lewis Brothers, builders, 6, Park Avenue, Failsworth.

Mansfield.—Houses (20), Ravensdale Estate; W. Thompson, borough engineer.

Newburn-on-Tyne.—Houses (24), Westhope Estate, for P. H. Oxnard, builder.

Newcastle-on-Tyne.—Cinema, Bykers Bat, Shields Road; Stienlet & Maxwell, 5, Saville Chambers, Saville Row. Offices, Forth Lane, for Barlett & Co.; and extensions, Millvane Club and Institute, Hoyle Avenue (£5,000); W. Smelt, builder, West Road. New department, Cowgate School (450 places); Marshall & Tweedy, architects, Pilgrim Street. Alterations, Empire Theatre, Newgate Street; W. & T. R. Milburn, architects, 17, Fawcett Street, Sunderland. Extensions to offices of Percy Building Society, Market Street; Newcombe & Newcombe, architects, Eldon Square.

Newport.—County hall, offices, and shops; Isle of Wight county architect.

Northallerton (YORKS).—Houses (98), south of Boroughbridge Road; A. Smith, builder. R.C. church, Thirsk Road; priest-in-charge.

Northampton.—Houses, Abington Estate (100), and St. David's Estate (76); borough engineer. Houses (83), Ennerdale Road, &c.; Chowns, Ltd.

North Riding.—Improvements, Mental Hospital (£4,000); J. R. White, county architect, County Hall, Northallerton.

North Shields.—Houses (24), Lynn Road; F. R. N. Haswell and Son, architects, 77, Tyne Street.

Oxford.—Theatre; T. H. Kinderly, builder, 35, Queen Street.

Paisley.—Houses (264); burgh surveyor. Additions to printing department, for the United Thread Mills, Ltd.; manager.

Pontefract.—Houses (40), Wakefield Road; borough surveyor.

Ramsgate.—Shops and houses, St. Luke's Avenue and College Lane, for W. W. Martin, builder, South Eastern Works.

Rochester (KENT).—Cinema (2,000 seats), High Street, for the Southern Proprietary Holdings, Ltd.; H. Weston, 6, Finsbury Square, E.C.2.

Seaham Harbour.—Houses (100), Deneside Estate; J. Clarke and Sons, builders, New Seaham.

Sevenoaks.—Extensions, Sevenoaks and Holmesdale Hospital (£15,000); secretary.

Sheffield.—Houses (52), Firth Park; C. S. Smith. Houses (449), Hall Road; Miss I. M. Hellewell. Houses (32), High Storrs Drive; A. S. Shaw. Houses (30), Hollinsend Road; Maxfield Bros. Houses (320), Hollinshill Estate; Hallewell Estates, Ltd. Houses (118), Thorpe House Estate; W. & J. Lavers. Junior technical school (£3,000), for E.C.

Slough.—Gilliat Hall (£4,559); Gradwell, Ltd., builders.

Southport.—Technical college; Cruickshank & Seward, architects, Crown Buildings, 18, Booth Street, Manchester.

South Shields.—Houses (28), various sites for J. T. Armstrong, back of Talbot Road. Alterations and additions to T. & G. Allen's premises, King Street, and to the British and Oriental Stores, Ocean Road; Glass, Harrison & Ash, architects, 20, Saville Row, Newcastle.

Stalybridge.—Houses (22), Huddersfield Road; A. V. M. Deane.

Stenhousemuir (STIRLINGSHIRE).—Houses (28); T. M. Copland & Blakey, architects, Falkirk.

Stockton-on-Tees.—School, Newham Grange, for E.C.; G. P. Stainsby, architect, 25, High Street.

Stourbridge.—Houses (18), Grange House Estate; borough surveyor. Works extensions, Pedmore Road, Lye, for Ludlow Bros., Ltd.

Surrey.—School, Eagle House, Mitcham, for County E.C.

Sutton Coldfield.—Houses (33), Boldmere Road; T. P. Smith, Ltd.

Swindon.—Stores, 126, Crockdale Road; Tydeman Bros., Ltd.

Tamworth.—Houses (194); borough surveyor.

Tewkesbury.—Cinema, High Street; W. Leah, architect, Midland Bank Chambers, Gloucester.

Thirsk.—Cinema; A. J. Oates, builder, 2, Pasture Road, Goole.

Tipton.—Houses (44); U.D.C. surveyor.

Uttoxeter.—Houses (20); C. E. Ingham, R.D.C. surveyor, Northgate.

Wallsend-on-Tyne.—Houses (222), Churchill Road; Battle Hill Estate Co., builders. Houses (13), near Shafto Street; H. Turner, builder.

Warminster.—Factory extensions, Station Road, for A. L. Jefferies, Ltd.

Warrington.—Houses (26), Grantham Avenue; T. & C. Rigby.

Watford.—Houses (18); Modern Construction Co., builders.

West Bromwich.—Houses (300), Hambletts Estate (£30,926); Eadie & Co., Wolverhampton.

West Kirby.—Tudor Cinema (£30,000), with electrical work; Metcalfe Bros., builders, Doncaster.

West Riding.—School (350 places), Listerdale; director of education, Wakefield.

Wigan.—Works extensions, Dorning Street, for Santus & Co.

Worcester.—Extensions, Newtown Hospital; W. Ransom, city engineer.

Worthing.—Houses (34), George V. Avenue; C. A. Jarvis. Houses (135), Meadow Road; Messrs. Pipers. Houses (36), Sheridan Road; S. C. Phillips. Ten shops and houses, Upper Brighton Road; R. Hodgson. Reconstruction of Royalty Theatre, Montague Street; F. C. Mitchell, architect.

York.—Houses (120), Huntingdon Road (£41,600); R. G. Tarran, Hull. Flats (44), Heworth Grange; city engineer. Estate development, Dringhouses; W. Simpson.

The International H.P. Distribution Conference

THIRTY-ONE countries, with a total of 700 registrations, are taking part in the International Conference of H.P. Distribution Systems which opens in Paris to-day (Friday) and will continue until June 24th. The work of the Conference will be divided into three main sections, viz.: (1) generation and distribution; (2) transmission line construction and insulation; and (3) the operation and protection of distribution systems. About 120 reports and papers are to be submitted to the various meetings, these emanating from experts in no fewer than eighteen different countries. Germany is the most prolific contributor with twenty-five papers, followed by France with nineteen, Switzerland twelve, Soviet Russia eleven, Belgium and Czecho-Slovakia eight each, Hungary, Italy, and Japan six each, Great Britain and the United States five each, Poland three, Holland and Norway two each, and Austria, Canada, Roumania and Spain one each. The British contributors include Mr. B. L. Goodlet, who will speak on "Insulation by Resinous Paper." Mr. J. Ryle on "The Vibration of Overhead Conductors," Messrs. C. O. Boyse and F. de B. Hart on "The 132,000-V Transmission Line across the River Thames," Mr. J. John on "Outdoor H.t. Fuses," and Mr. E. T. Norris on "The Protection of Electrical Plant against Excess Pressures."